



Agilent 75000 SERIES C

Agilent E1465A/E1466A/E1467A Matrix Switches

Service Manual

The information in this manual applies directly to:

E1465A 16x16 Matrix Switches

E1466A 4x64 Matrix Switches

E1467A 8x32 Relay Matrix Switches



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E1465-90011

Contents

Agilent E1465A/E1466A/E1467A Service Manual

Chapter 1. General Information	9
Introduction	9
Relay Life	10
End-of-Life Detection	10
Replacement Strategy	10
Safety Considerations	11
Warnings and Cautions	11
Inspection/Shipping	13
Initial Inspection	13
Shipping Guidelines	15
Environment	16
Matrix Description	16
Matrix Specifications	16
Matrix Serial Numbers	16
Matrix Options	17
Schematics/Component Locators	17
Recommended Test Equipment	17
Chapter 2. Verification Tests	19
Introduction	19
Test Conditions/Procedures	19
Performance Test Record	19
Verification Test Examples	19
Matrix Module Functional Verification	20
Procedure	20
Operation Verification	20
Performance Verification	20
Wiring the Test Fixture	21
Test 2-1: Closed Channel Resistance Test	23
Test 2-2: DC Isolation Test	29
Performance Test Record	33
Test Limits	33
Measurement Uncertainty	34
Test Accuracy Ratio (TAR)	34
Chapter 3. Replaceable Parts	45
Introduction	45
Ordering Information	45
Replaceable Parts Lists	45

Chapter 4. Service	55
Introduction	55
Repair Strategy	55
Equipment Required	55
Service Aids	55
Troubleshooting	56
Identifying the Problem	56
Testing the Assembly	57
Self-Test Error Codes	67
Disassembly	67
Repair/ Maintenance Guidelines	69
ESD Precautions	69
Soldering Printed Circuit Boards	69
Post-Repair Safety Checks	70
Component Locators and Schematic Diagrams	70

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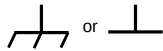
Safety Symbols



Instruction manual symbol affixed to product. Indicates that the user must refer to the manual for specific WARNING or CAUTION information to avoid personal injury or damage to the product.



Indicates the field wiring terminal that must be connected to earth ground before operating the equipment—protects against electrical shock in case of fault.



Frame or chassis ground terminal—typically connects to the equipment's metal frame.



Alternating current (AC).



Direct current (DC).



Indicates hazardous voltages.

WARNING

Calls attention to a procedure, practice, or condition that could cause bodily injury or death.

CAUTION

Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

WARNINGS

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal), an uninterruptible safety earth ground must be provided from the mains power source to the product input wiring terminals or supplied power cable.

DO NOT operate the product in an explosive atmosphere or in the presence of flammable gases or fumes.

For continued protection against fire, replace the line fuse(s) only with fuse(s) of the same voltage and current rating and type. DO NOT use repaired fuses or short-circuited fuse holders.

Keep away from live circuits: Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers or shields are for use by service-trained personnel only. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, DO NOT perform procedures involving cover or shield removal unless you are qualified to do so.

DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to an Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

DO NOT service or adjust alone: Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

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- Go to <http://regulations.corporate.agilent.com/DoC/search.htm> . You can then search by product number to find the latest Declaration of Conformity.
- Alternately, you can go to the product web page (e.g., www.agilent.com/find/E1466A), click on the Document Library tab then scroll down until you find the Declaration of Conformity link.

Notes

Notes

Notes

Chapter 1

General Information

Introduction

This manual contains information required to test, troubleshoot, and repair the Agilent E1465A 16 x 16 Relay Matrix, the E1466A 4 X 64 Relay Matrix, and the E1467A 8 X 32 Relay Matrix (see Figure 1-1).

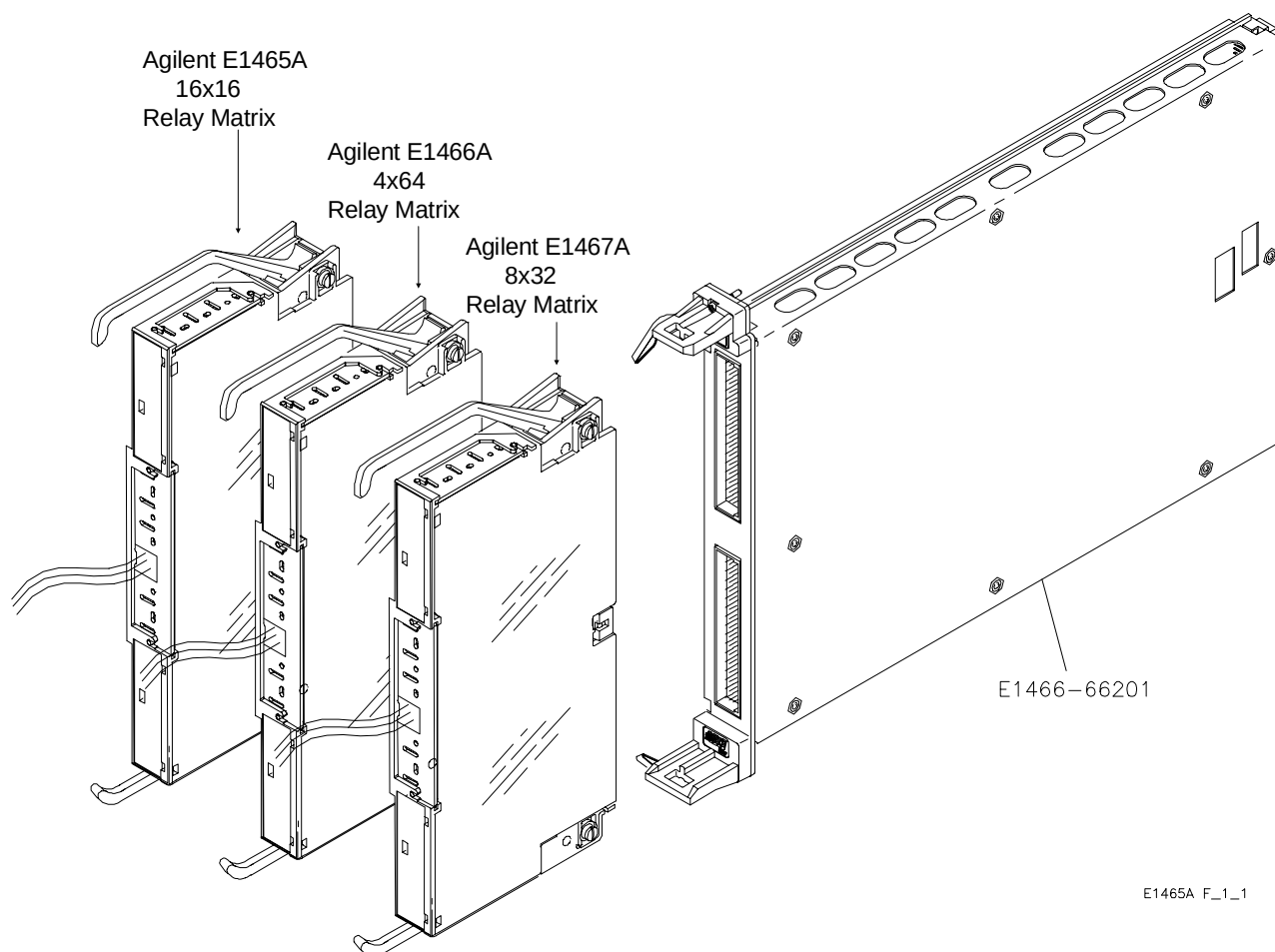


Figure 1-1. Agilent E1465A/E1466A/E1467A Matrixes

Relay Life

Electromechanical relays are subject to normal wear-out. Relay life depends on several factors. The effects of loading and switching frequency are briefly discussed below:

Relay Load. In general, higher power switching reduces relay life. In addition, capacitive/inductive loads and high inrush currents (e.g., when turning on a lamp or motor) reduce relay life. *Exceeding the specified maximum inputs can cause catastrophic failure.*

Switching Frequency. Relay contacts heat up when switched. As the switching frequency increases, the contacts have less time to dissipate heat. The resulting increase in contact temperature reduces relay life.

End-of-Life Detection

The contact resistance should be checked periodically to prevent problems caused by unexpected relay failure. The end of the life of a relay can be determined using one or more of the three methods described below. The best method (or combination of methods), as well as the failure criteria, depends on the application in which the relay is used.

Contact Resistance. As the relay begins to wear out, its contact resistance will increase. When the resistance exceeds a pre-determined value, the relay should be replaced. Typically, a relay should be replaced when the contact resistance exceeds 2.7 Ohm.

Stability of Contact Resistance. The stability of the contact resistance decreases with age. Using this method, the contact resistance is measured several (5-10) times, and the variance of the measurements is determined. An increase in the variance indicates deteriorating performance.

Number of Operations. Alternatively, relays can be replaced after a predetermined number of contact closures. However, this method requires knowledge of the applied load and life specifications for the applied load. For the Agilent E1465A/E1466A/E1467A maximum relay life is specified at 10^7 operations with no load and 10^5 operations at the maximum rated load.

Replacement Strategy

The replacement strategy also depends on the application. If some relays are used more often, or at higher load, than the others, the relays can be individually replaced as needed. If all of the relays see similar loads and switching frequencies, the entire circuit board can be replaced when the end of life approaches. The sensitivity of the application should be weighed against the cost of replacing relays with some useful life remaining.

NOTE

Relays that wear out normally or fail due to misuse should not be considered defective and are not covered by the product's warranty.

Safety Considerations

This product is a Safety Class I instrument that is provided with a protective earth terminal when installed in the mainframe. The instrument, mainframe, and all related documentation should be reviewed for familiarization with safety markings and instructions before operation or service.

Refer to the WARNINGS page (page 4) in this manual for a summary of safety information. Safety information for testing and service follows and is also found throughout this manual.

Warnings and Cautions

This section contains WARNINGS which must be followed for your protection and CAUTIONS which must be followed to avoid damage to the equipment when performing instrument maintenance or repair.

WARNING

SERVICE-TRAINED PERSONNEL ONLY. The information in this manual is for service-trained personnel who are familiar with electronic circuitry and are aware of the hazards involved. To avoid personal injury or damage to the instrument, do not perform procedures in this manual or do any servicing unless you are qualified to do so.

CHECK MAINFRAME POWER SETTINGS. Before applying power, verify that the mainframe setting matches the line voltage and that the correct fuse is installed. An uninterruptible safety earth ground must be provided from the main power source to the supplied power cord set.

GROUNDING REQUIREMENTS. Interruption of the protective (grounding) conductor (inside or outside the mainframe) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two-conductor outlet is not sufficient protection.)

IMPAIRED PROTECTION. Whenever it is likely that instrument protection has been impaired, the mainframe must be made inoperative and be secured against any unintended operation.

WARNING

REMOVE POWER IF POSSIBLE. Some procedures in this manual may be performed with power supplied to the mainframe while protective covers are removed. Energy available at many points may, if contacted, result in personal injury. (If maintenance can be performed without power applied, the power should be removed.)

USING AUTOTRANSFORMERS. If the mainframe is to be energized via an autotransformer (for voltage reduction) make sure the common terminal is connected to neutral (that is, the grounded side of the main's supply).

CAPACITOR VOLTAGES. Capacitors inside the mainframe may remain charged even when the mainframe has been disconnected from its source of supply.

USE PROPER FUSES. For continued protection against fire hazard, replace the line fuses only with fuses of the same current rating and type (such as normal blow, time delay, etc.). Do not use repaired fuses or short-circuited fuseholders.

SHOCK HAZARD. Only service-trained personnel who are aware of the hazards involved should install, remove, or configure the matrix. Before you remove any installed module, disconnect AC power from the mainframe and from other modules that may be connected to the matrix.

CHANNEL WIRING INSULATION. All channels that have a common connection must be insulated so that the user is protected from electrical shock. This means wiring for all channels must be insulated as though each channel carries the voltage of the highest voltage channel.

CAUTION

MAXIMUM INPUTS. The maximum voltage that can be applied is 200 V dc or 170 V ac rms Peak (238 V ac Peak-to-Peak) any terminal to any other terminal or chassis. The maximum current per channel is 1 A dc or ac Peak. The maximum power that can be applied to any channel 30 W or 62.5 VA (ac Resistive Load).

STATIC ELECTRICITY. Static electricity is a major cause of component failure. To prevent damage to the electrical components in the matrix, observe anti-static techniques whenever working on the device.

Inspection/ Shipping

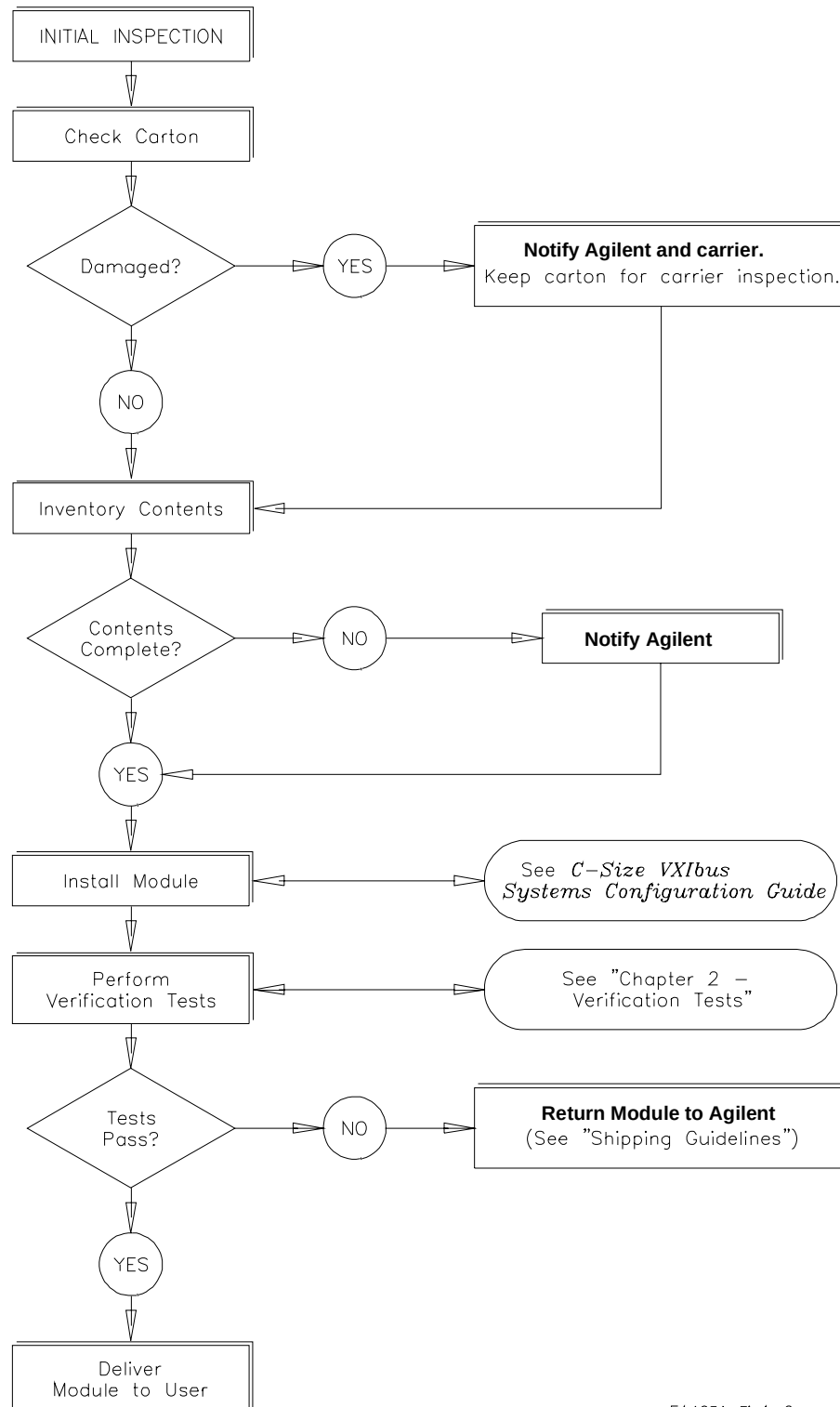
This section contains initial (incoming) inspection and shipping guidelines for the matrix modules.

Initial Inspection

Use the steps in Figure 1-2 as guidelines to perform initial inspection of one of the modules. Verification Tests are optional.

WARNING

To avoid possible hazardous electrical shock, do not perform electrical tests if there are signs of shipping damage to the shipping container or to the instrument.



E1465A Fig1-2

Figure 1-2. Initial (Incoming) Inspection Guidelines

Shipping Guidelines

Follow the steps in Figure 1-3 to return a matrix module to a Agilent Technologies Sales and Support Office or Service Center.

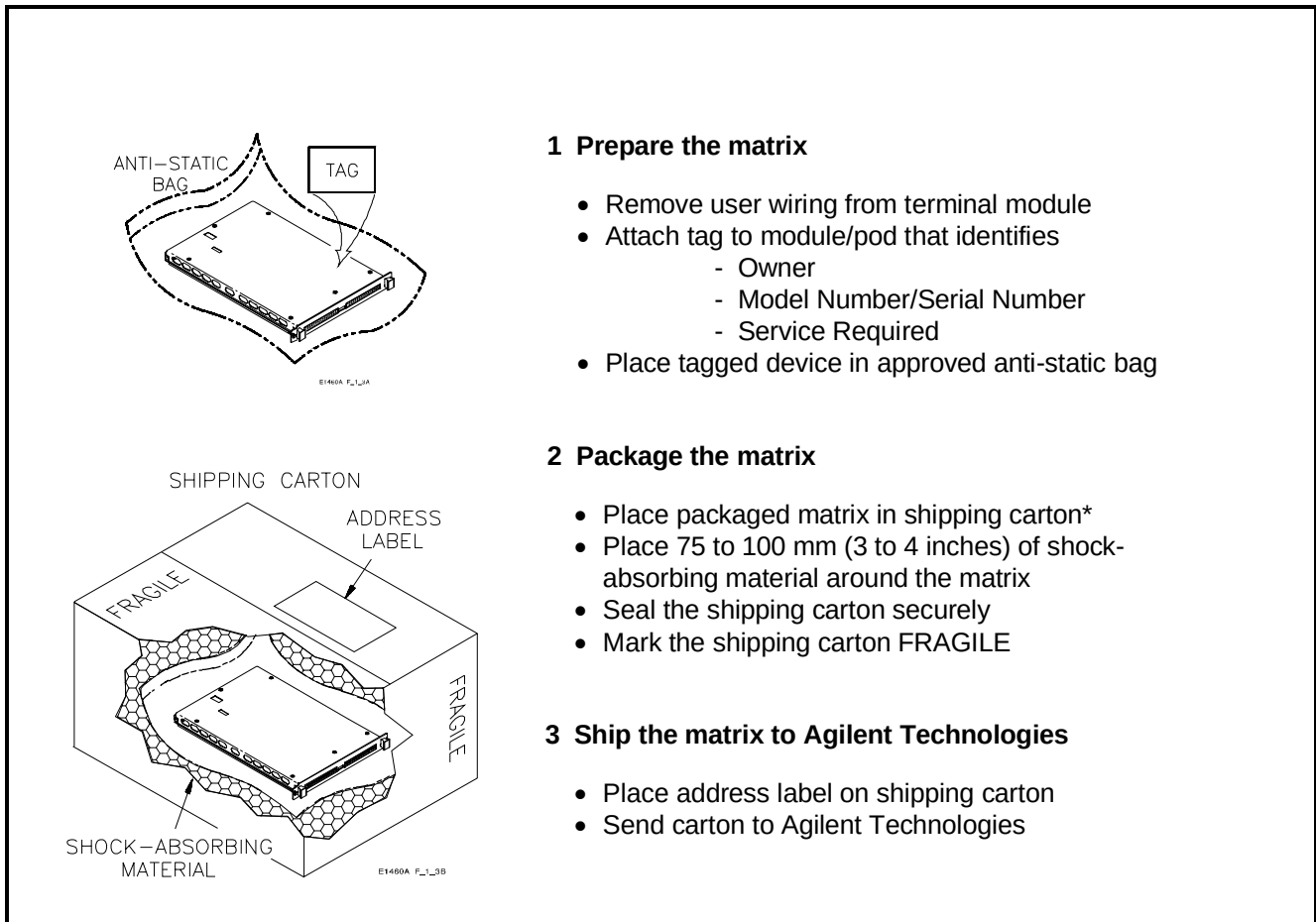


Figure 1-3. Packaging/Shipping Guidelines

* We recommend that you use the same shipping materials as those used in factory packaging (available from Agilent Technologies). For other (commercially-available) shipping materials, use a double-wall carton with minimum 2.4 MPa (350 psi) test.

Environment

The recommended operating environment for the matrixes is:

Environment	Temperature	Humidity
Operating	0°C to +55°C	<65% relative (0°C to +40°C)
Storage and Shipment	-40°C to +75°C	<65% relative (0°C to +40°C)

Matrix Description

The Agilent E1465A/E1466A/E1467A matrix modules are "instruments" in the slots of a VXIbus mainframe. Each module is assigned an error queue, input and output buffers, and a status register.

NOTE

Instruments are based on the logical addresses of the plug-in modules. See the Agilent 75000 Series C Installation and Getting Started Guide to set the addresses to create an instrument.

Each matrix has two parts: a component module and a terminal module (See Figure 1-1). The component module contains 256 latching relays implemented as four 4 X 16 submatrixes. The terminal modules convert these submatrixes into a 16 X 16 (Agilent E1465A), 4 X 64 (Agilent E1466A), or 8 X 32 (Agilent E1467A) matrix. The terminal module matrixes are two-wire crosspoint switching (HI and LO). The matrix module number reported in response to the SCPI SYSTem: commands is determined by the terminal module installed. With no terminal module installed, the model number is reported as E1466A.

Matrix Specifications

Specifications are listed in Appendix A of the *Agilent E1465A/E1466A/E1467A Relay Matrices User's Manual*. These specifications are the performance standards or limits against which the modules may be tested.

Matrix Serial Numbers

Devices covered by this manual are identified by a serial number prefix listed on the title page. Agilent Technologies uses a two-part serial number in the form XXXXAYYYYY, where XXXX is the serial prefix, A is the country of origin (A=USA), and YYYYYY is the serial suffix. The serial number prefix identifies a series of identical instruments. The serial number suffix is assigned sequentially to each instrument. The serial number plate is located on the right-hand shield near the backplane connectors.

Matrix Options

The Agilent E1467A Option 211 provides a special matrix expansion terminal module. No other Options to the matrixes are available.

Schematics/ Component Locators

Component locators and schematics for the modules are packaged with this manual. Clear plastic sleeves are included for storage.

Recommended Test Equipment

Table 1-1 lists the test equipment recommended for testing and servicing the modules. Essential requirements for each piece of test equipment are described in the requirements column.

Table 1-1. Recommended Test Equipment

Instrument	Requirements	Recommended Model	Use*
Controller, GPIB	GPIB compatibility as defined by IEEE Standard 488-1988 and the identical ANSI Standard MC1.1: SH1, AH1, T2, TE0, L2, LE0, SR0, RL0, PP0, DC0, DT0, and C1, 2, 3, 4, 5.	HP 9000 Series 300 or IBM Compatible PC with BASIC	F,O, P,T
Mainframe	Compatible with matrix module	E1401B/T or E1421B	F,O, P,T
Command Module	Compatible with matrix module	E1405A/B or E1406A	F,O, P,T
Digital Multimeter	4-wire ohms 2-wire ohms (up to 1 G Ω)	Agilent 3458A or Agilent 34401A	O,P, T

* F = Functional Verification Tests, O = Operation Verification Tests, P = Performance Verification Tests, T = Troubleshooting

Chapter 2

Verification Tests

Introduction

The three levels of test procedures described in this chapter are used to verify that the Agilent E1465A/E1466A/E1467A matrix module:

- is fully functional (Functional Verification)
- meets selected testable specifications (Operation Verification)
- meets all testable specifications (Performance Verification)

Test Conditions/ Procedures

See Table 1-1 for test equipment requirements. You should complete the Performance Verification tests at least once a year. For heavy use or severe operating environments, perform the tests more often.

The verification tests assume that the person performing the tests understands how to operate the mainframe, the matrix module, and specified test equipment. The test procedures do not specify equipment settings for test equipment, except in general terms. It is assumed that a qualified, service-trained technician will select and connect the cables, adapters, and probes required for the test.

It is assumed that the temperature is no greater than 25°C and the relative humidity is no greater than 40%.

Performance Test Record

The results of each Performance Verification test may be recorded in the Performance Test Record (Table 2-1).

Verification Test Examples

Each verification test procedure includes an example program that performs the test. All example programs assume the following:

- Controller is an HP 9000 Series 200/300 computer
- Programming language is BASIC
- Switch address is 70915
- Switch card number is 1

Matrix Module Functional Verification

The Functional Verification Test for the Agilent E1465A/E1466A/E1467A matrix modules consists of sending the *TST? command and checking the response. This test can be used at any time to verify that the device is connected properly and is responding to basic commands.

Procedure

1. Verify that the matrix module is installed in the mainframe and that the mainframe has passed its power-on test.
2. Send the *TST? command to the device (see example following).
3. The device will return an error code. Any non-zero error code indicates a self-test failure. See Table 4-4 for a description of self-test error codes.

NOTE

If a terminal module is not connected, the module defaults to a 4 x 64 configuration and the device description is E1466A.

Example

An example follows which uses an HP 9000 Series 300 computer with BASIC and a matrix module address of 70915.

10	OUTPUT 70915;"*TST?"	<i>Send the self-test command</i>
20	ENTER 70915;A	<i>Get response</i>
30	PRINT A	
40	END	

Operation Verification

The procedures in this section are used to provide a high confidence that the matrix module is meeting published specifications. The Operation Verification tests are a subset of the Performance Verification tests and are suitable for checkout after performing repairs.

For the Agilent E1465A/E1466A/E1467A matrix modules, Operation Verification is performed by completing the Closed Channel Resistance Test as described in the Performance Verification test procedures (Test 2-1). This test is usually sufficient to verify that the instrument is meeting its specifications.

Performance Verification

The procedures in this section are used to test the module's electrical performance using the specifications in Appendix A of the *Agilent E1465A/E1466A/E1467A Relay Matrix Switch Modules User's Manual* as the performance standards.

The performance verification tests have two parts: a closed channel resistance test of all relay contacts (Test 2-1) and a DC isolation test (Test 2-2). These tests are sufficient to determine that the module is operating within specifications. These tests are suitable for incoming inspection, troubleshooting, and preventive maintenance.

Wiring the Test Fixture

A test fixture is required for the performance verification tests. Figure 2-1 shows typical connections using an Agilent E1465A terminal module for the test fixture. Figure 2-2 shows typical connections using an Agilent E1466A terminal module for the test fixture. Figure 2-3 shows typical connections using an Agilent E1467A terminal module for the test fixture.

Any one of these terminal modules may be used to test the component assembly. You may want to order an extra terminal module to use as a test fixture, so you don't have to re-wire each time the tests are performed. The terminal module part numbers are:

Module	Terminal Module (with release levers)	Terminal Module (without release levers)
E1465A	E1465-80010	E1465-80001
E1466A	E1466-80010	E1466-80001
E1467A	E1467-80010	E1467-80001

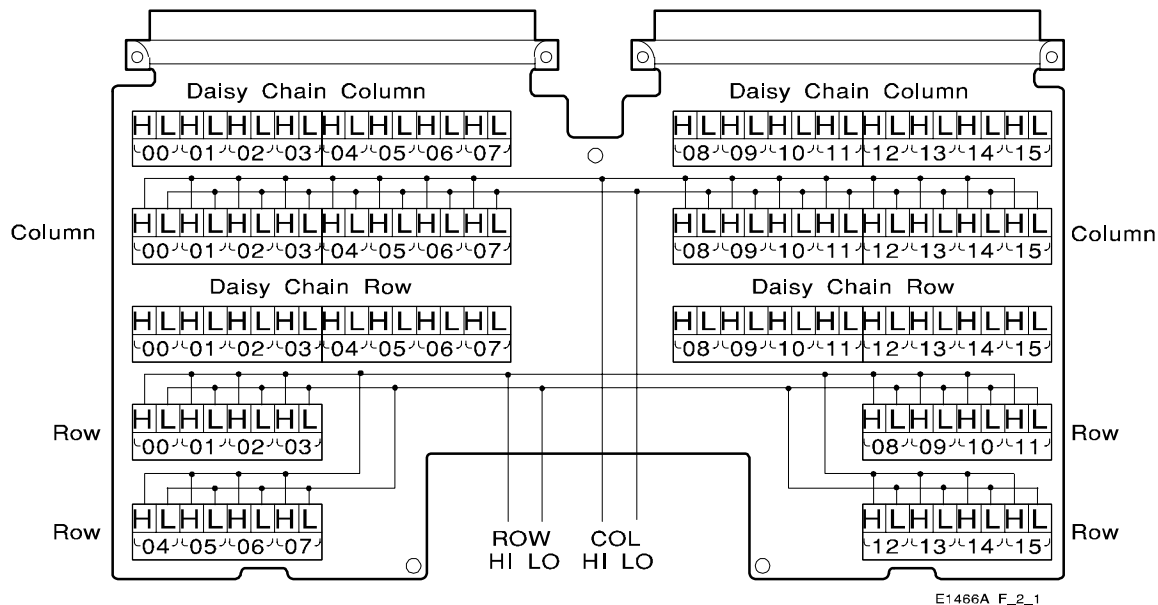


Figure 2-1. Agilent E1465A Test Fixture

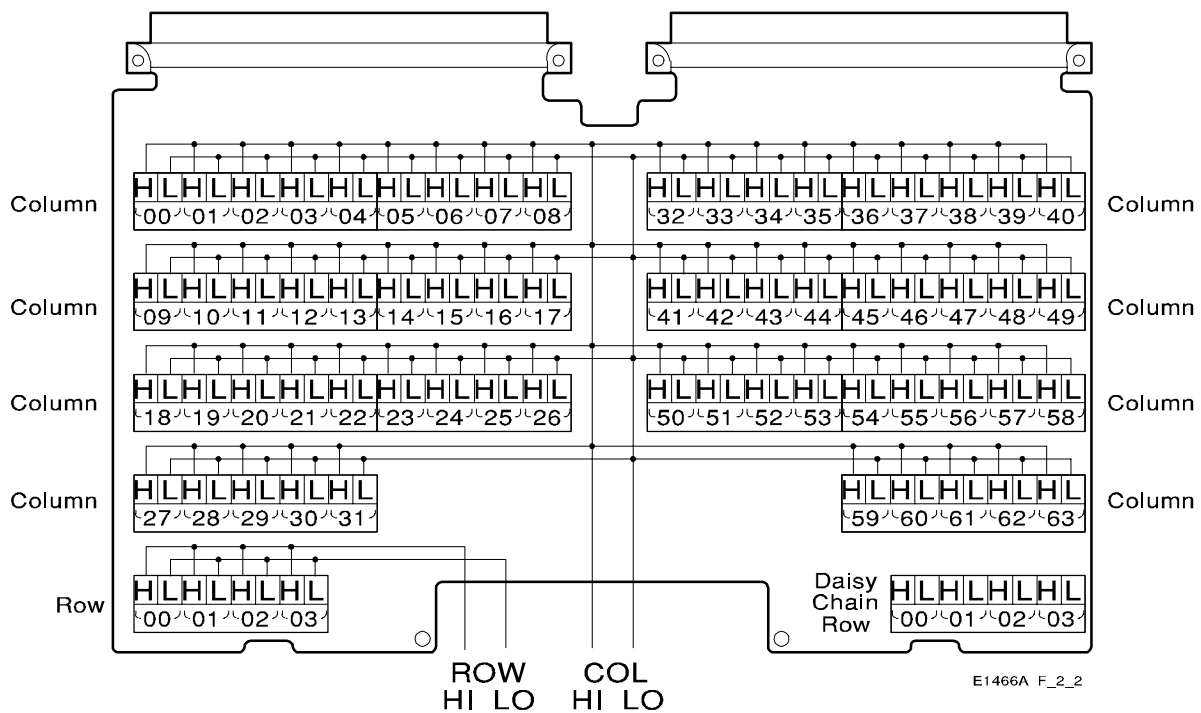


Figure 2-2. Agilent E1466A Test Fixture

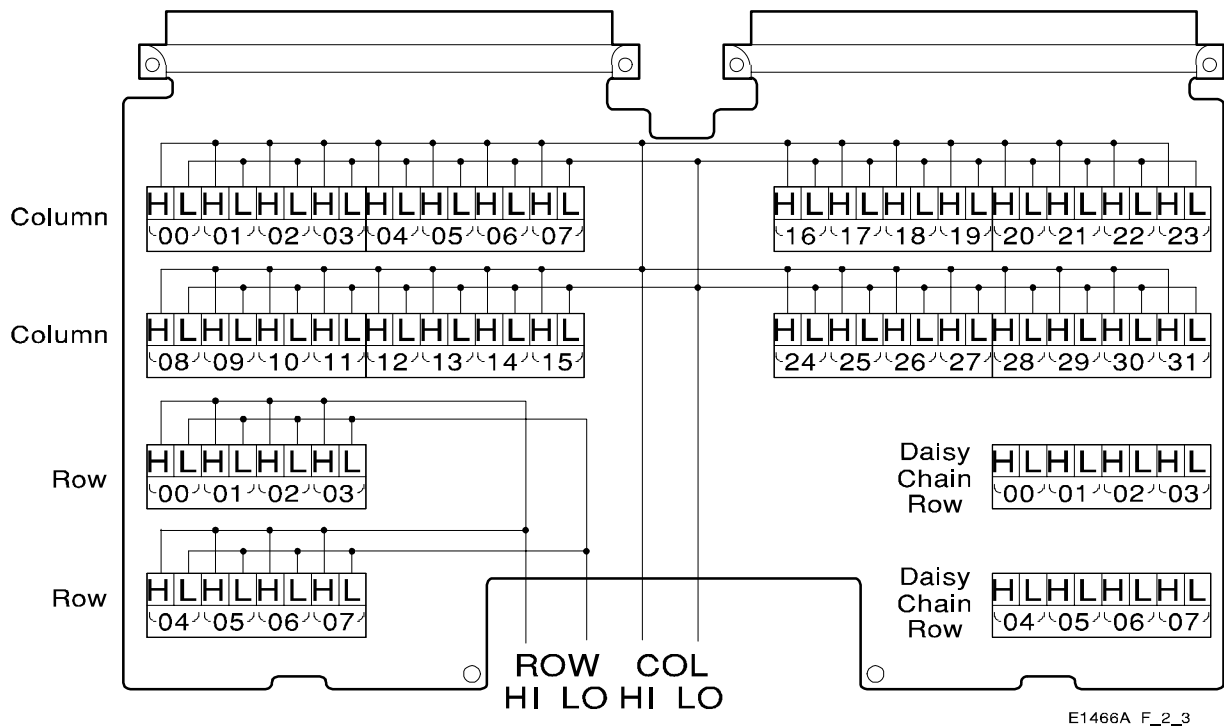


Figure 2-3. Agilent E1467A Test Fixture

Test 2-1: Closed Channel Resistance Test

This test verifies that all relay contacts meet the closed-channel resistance specification for the module. When making the Closed Channel Resistance Test, the HI and LO paths relay contacts are tested independently. This test uses the test fixture (see Figures 2-1, 2-2, or 2-3). The end-of-life Closed Channel resistance specification for each relay contact is $2.7\ \Omega$.

NOTE

Closed channel resistance for new relays should be $<1.8\ \Omega$. If you are testing new relays and the resistance is $>1.8\ \Omega$, you may want to check the relays, see Chapter 4 — Service.

Column HI to Row HI Measurements

1. Make Hardware Connections

- Turn mainframe power OFF
- Connect DMM leads as shown in Figure 2-4
- Set DMM to measure 4-wire Ohms
- Turn mainframe power ON

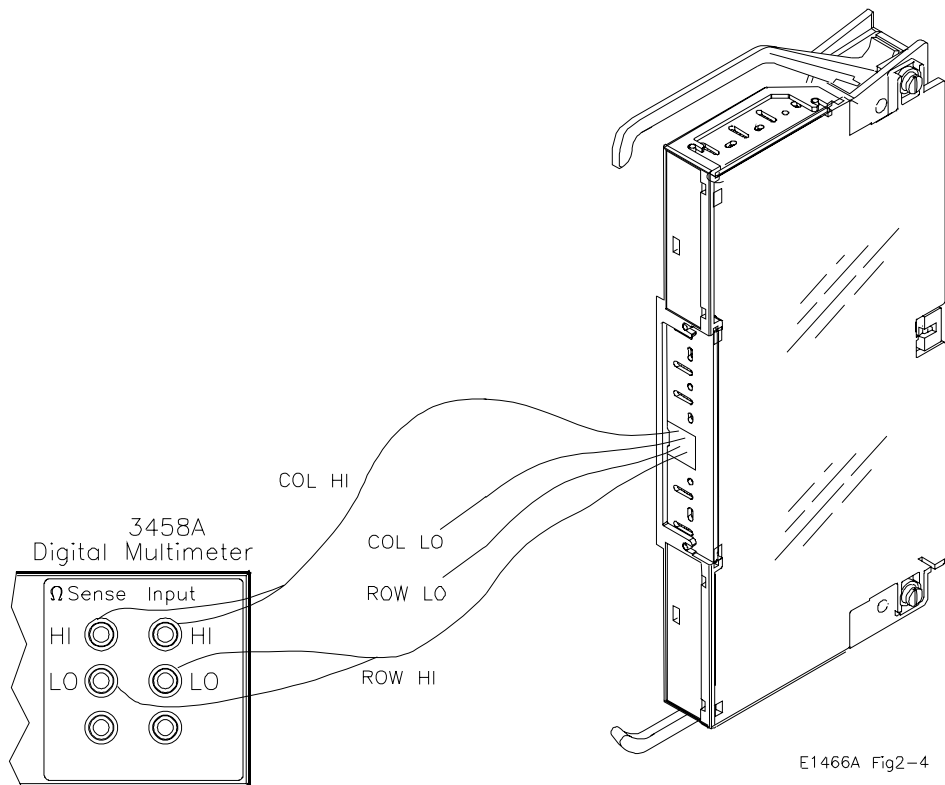


Figure 2-4. Column HI to Row HI Test Connections

2. Ensure all relays are open

- Send *RST to Module
- Trigger the DMM with TRIG SGL and note reading
- DMM reading should indicate an open condition ($> 1.2 \text{ G}\Omega$)

3. Measure Column 00 to Row 00 HI path resistance

- Send CLOS (@nn0000) to close column 0 row 0, where *nn* = card # (typically 01)
- Trigger the DMM with TRIG SGL and note reading
- Send OPEN (@nn0000) to open column 0 row 0, where *nn* = card # (typically 01)
- Enter the result in Table 2-1 for column 0 row 0

4. Repeat for all Columns

- Repeat step 3 for all columns
- Use CLOS (@nn00cc) and OPEN (@nn00cc), where *nn* = card # and *cc* = column # (omit leading zeroes in *nn*)
 - For E1465A use column numbers 01 through 15
 - For E1466A use column numbers 01 through 63
 - For E1467A use column numbers 01 through 31

5. Repeat for all Rows

- Repeat steps 3 and 4 for all rows
- Use CLOS (@nnrrcc) and OPEN (@nnrrcc), where *nn* = card #, *rr* = row #, and *cc* = column # (omit leading zeroes in *nn*)
 - For E1465A use row numbers 01 through 15
 - For E1466A use row numbers 01 through 03
 - For E1467A use row numbers 01 through 07

Column LO to Row LO Measurements

1. Make Hardware Connections

- Turn mainframe power OFF
- Set DMM to measure 4-wire Ohms
- Connect DMM leads as shown in Figure 2-5
- Turn mainframe power ON

2. Repeat steps 2 through 5 of the "Column HI to Row HI Measurements"

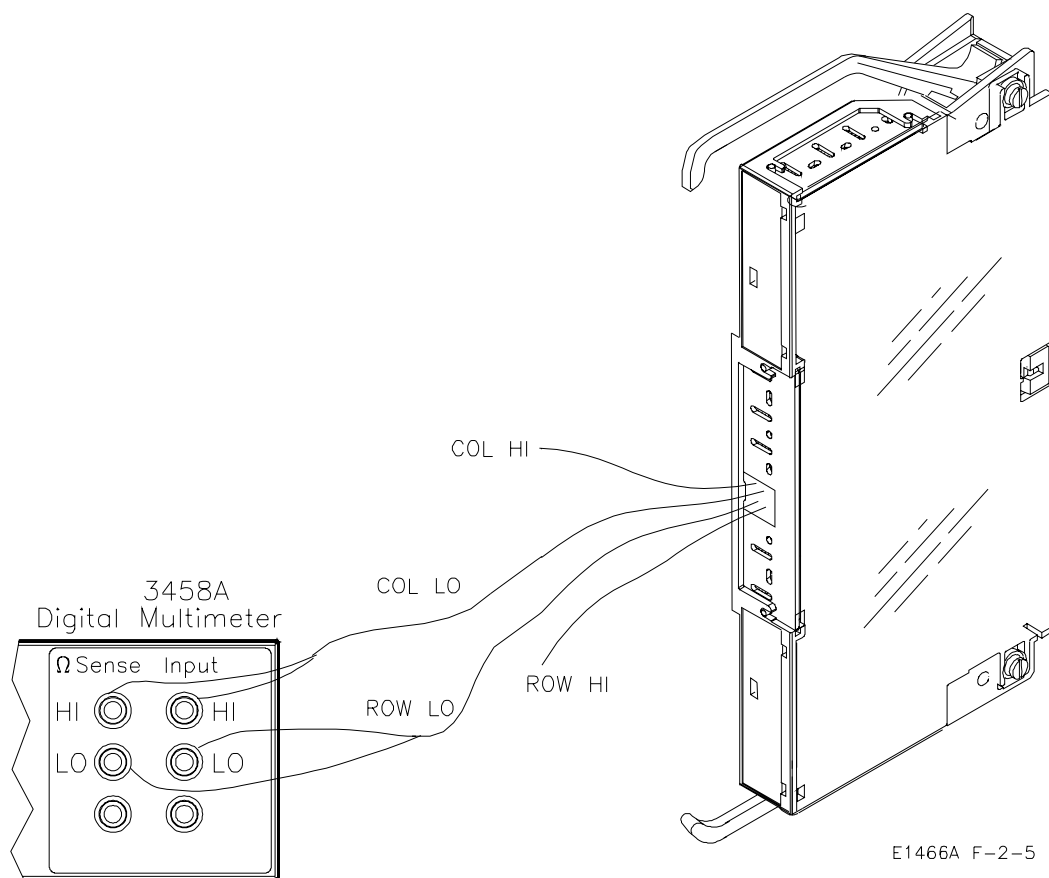


Figure 2-5. Column LO to Row LO Test Connections

Example: Closed Channel Resistance Test

This example performs a Closed Channel Resistance Test to measure the matrix relay contact resistances. If the relay contact resistance for a channel is $>2.7 \Omega$ the program prints a message indicating which channel has failed the test. Use this list in *Chapter 4 — Service* when troubleshooting a failing relay.

```

10! RE-SAVE "CLOS_TEST"
20  ASSIGN @Dmm TO 722
30  ASSIGN @Sw TO 70915
40  DISP CHR$(129)
50  DIM Path$(1)[2],Row$(2),Col$(2),Val_h(15,63),Val_l(15,63),A$[255]
60  DATA HI,LO
70  READ Path$(*)
80  Cc$="01"! Card number
90  Ph$="0" ! Place holder
100 CLEAR SCREEN
110 PRINT "Install Component Assembly and Test Fixture "
120 PRINT

```

```

130 PRINT " 1. Turn Mainframe and Agilent 3458A DMM power OFF"
140 PRINT " 2. Connect GPIB cable between mainframe and DMM"
150 PRINT " 3. Install Component Assembly into Mainframe "
160 PRINT " 4. Attach Test fixture to Component Assembly"
170 PRINT " 5. Turn mainframe and DMM power ON "
180 PRINT " 6. Press Continue when ready to begin testing"
190 PAUSE
200 OUTPUT @Sw;"*CLS"
210 OUTPUT @Sw;"SYST:CDES? "&Cc$
220 ENTER @Sw;A$
230 SELECT A$[2,2]
240 CASE "1"
250   Row=15
260   Col=15
270 CASE "4"
280   Row=3
290   Col=63
300 CASE "8"
310   Row=7
320   Col=31
330 CASE ELSE
340   PRINT "Wrong card type detected ";A$
350   STOP
360 END SELECT
370 FOR T=0 TO 1
380   CLEAR SCREEN
390   PRINT "Make test connections for Column ";Path$(T);" Measurements"
400   PRINT
410   PRINT " 1. Connect DMM Input and Sense HI leads to the Test Fixture
Column ";Path$(T)
420   PRINT " 2. Connect DMM Input and Sense LO leads to the Test Fixture
Row ";Path$(T)
430   PRINT " 3. Press Continue when test connections are complete"
440   DISP "Press Continue"
450   PAUSE
460   !
470   ! Make the measurement
480   !
490   OUTPUT @Dmm;"PRESET NORM;FUNC OHMF"
500   OUTPUT @Sw;"*RST"
510   OUTPUT @Sw;"*CLS"
520   OUTPUT @Sw;"*OPC?"
530   ENTER @Sw;Opc

```

```

540 IF Opc <> 1 THEN 520
550 ! Check for stuck relays
560 OUTPUT @Dmm;"TRIG SGL"
570 ENTER @Dmm;A
580 IF A<1.E+6 THEN
590     PRINT "Stuck relay found"
600     PRINT "Correct the problem and re-run test"
610     STOP
620 END IF
630 ! Begin contact resistance test
640 FOR J=0 TO Row
650     IF J<10 THEN
660         Row$=Ph$&VAL$(J)
670     ELSE
680         Row$=VAL$(J)
690     END IF
700     FOR K=0 TO Col
710         IF K<10 THEN
720             Col$=Ph$&VAL$(K)
730         ELSE
740             Col$=VAL$(K)
750         END IF
760         OUTPUT @Sw;"CLOS (@"&Cc$&Row$&Col$&")"
770         OUTPUT @Sw;"*OPC?"
780         ENTER @Sw;Opc
790         IF Opc <> 1 THEN 770
800         OUTPUT @Dmm;"TRIG SGL"
810         IF T=0 THEN
820             ENTER @Dmm;Val_h(J,K)
830             IF Val_h(J,K)<0 THEN Val_h(J,K)=0
840             IF Val_h(J,K)>2.7 THEN
850                 PRINT "Row ";J," to Column ";K;Path$(T);" path is > 2.7 Ohms"
860                 IF Val_h(J,K)>99.9999 THEN Val_h(J,K)=99.9999
870             END IF
880         ELSE
890             ENTER @Dmm;Val_l(J,K)
900             IF Val_l(J,K)<0 THEN Val_l(J,K)=0
910             IF Val_l(J,K)>2.7 THEN
920                 PRINT "Row ";J," to Column ";K;Path$(T);" path is > 2.7 Ohms"
930                 IF Val_l(J,K)>99.9999 THEN Val_l(J,K)=99.9999
940             END IF
950         END IF
960         OUTPUT @Sw;"OPEN (@"&Cc$&Row$&Col$&")"

```

```

970    NEXT K
980    NEXT J
990    CLEAR SCREEN
1000   PRINT "Measurements complete for Row ";Path$(T); " To Column
";Path$(T)
1010   IF T=0 THEN
1020     DISP "Press continue for Row ";Path$(T+1); " to Column ";Path$(T+1)
1030   ELSE
1040     DISP "Press continue to print measurement results"
1050   END IF
1060   PAUSE
1070   NEXT T
1080   CLEAR SCREEN
1090   !
1100   ! Print Measurement Results
1110   !
1120   Format: IMAGE "Row ",DD," to Col ",DD,3X,DD.DDDD," Ohms
";5X,DD.DDDD," Ohms"
1130   PRINT TABXY(1,3)," HI Path  LO Path"
1140   PRINT
1150   FOR J=0 TO Row
1160     FOR K=0 TO Col
1170       PRINT USING Format;J,K,Val_h(J,K),Val_l(J,K)
1180     NEXT K
1190   NEXT J
1200   END

```

Typical Result

	HI Path	LO Path
Row 0 to Col 0	.4162 Ohms	.4047 Ohms
Row 0 to Col 1	.4045 Ohms	.4151 Ohms
Row 0 to Col 2	.3947 Ohms	.3875 Ohms
•	ù	•
•	ù	•
•	ù	•
Row 7 to Col 29	.4127 Ohms	.4007 Ohms
Row 7 to Col 30	.4002 Ohms	.4111 Ohms
Row 7 to Col 31	.4047 Ohms	.4245 Ohms

Test 2-2: DC Isolation Test

This test verifies that sufficient DC isolation exists at various points on the Module. DC Isolation is checked from HI to LO, HI to Chassis, and LO to Chassis. This test uses the test fixture (see Figures 2-1, 2-2, or 2-3).

NOTE

The DMM used should be capable of measuring at least 1 G Ω .. If the DMM indicates an overload, record the reading as >Rmax, where Rmax is the highest resistance that the DMM can measure. For example, if the DMM is an Agilent 3458A, a typical return for an overload is 1.E+38 and the entry in Table 2-1 should be >1.2 G Ω ..

HI to LO Isolation

1. Make hardware connections as shown in Figure 2-6
2. Set DMM to 2-wire ohms, 1 G Ω range
3. Send CLOS (@10000:1rrcc) to the matrix to close all relays
where *rr* = highest row number and *cc* = highest column number
For E1465A, *rr* = 15 and *cc* = 15
For E1466A, *rr* = 03 and *cc* = 63
For E1467A, *rr* = 07 and *cc* = 31
4. Trigger the DMM with TRIG SGL

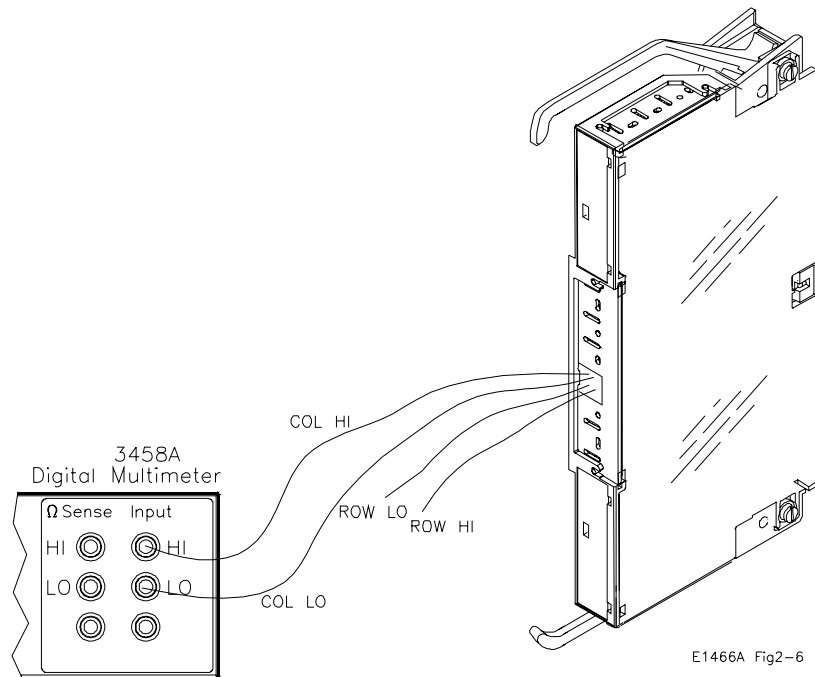


Figure 2-6. HI to LO DC Isolation Test Connections

- Record the DMM reading in Table 2-1 (HI to LO)

HI to Chassis Isolation

- Make hardware connections as shown in Figure 2-7
- Set DMM to 2-wire ohms, 1 G Ω range
- Send CLOS (@10000:1rrcc) to the matrix to close all relays
where *rr* = highest row number and *cc* = highest column number
For E1465A, *rr* = 15 and *cc* = 15
For E1466A, *rr* = 03 and *cc* = 63
For E1467A, *rr* = 07 and *cc* = 31
- Trigger the DMM with TRIG SGL

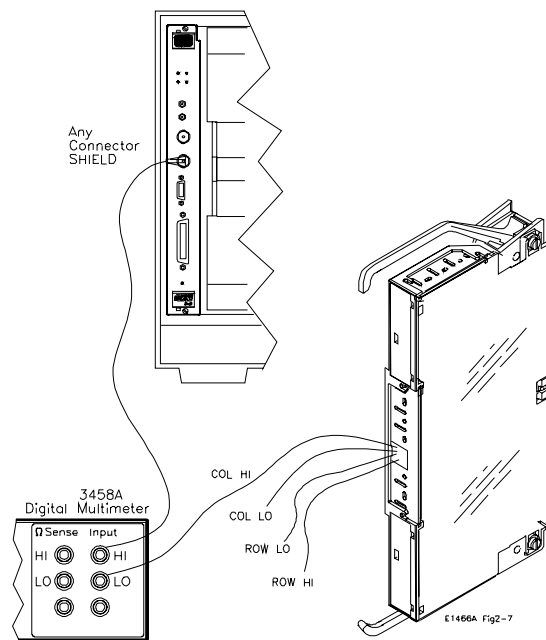


Figure 2-7. HI to Chassis Isolation Test Connections

- Record the DMM reading in Table 2-1 (HI to Chassis)

LO to Chassis Isolation

- Make hardware connections as shown in Figure 2-8
- Set DMM to 2-wire ohms, 1 G Ω range
- Send CLOS (@10000:1rrcc) to the matrix to close all relays
where *rr* = highest row number and *cc* = highest column number
For E1465A, *rr* = 15 and *cc* = 15
For E1466A, *rr* = 03 and *cc* = 63
For E1467A, *rr* = 07 and *cc* = 31
- Trigger the DMM with TRIG SGL

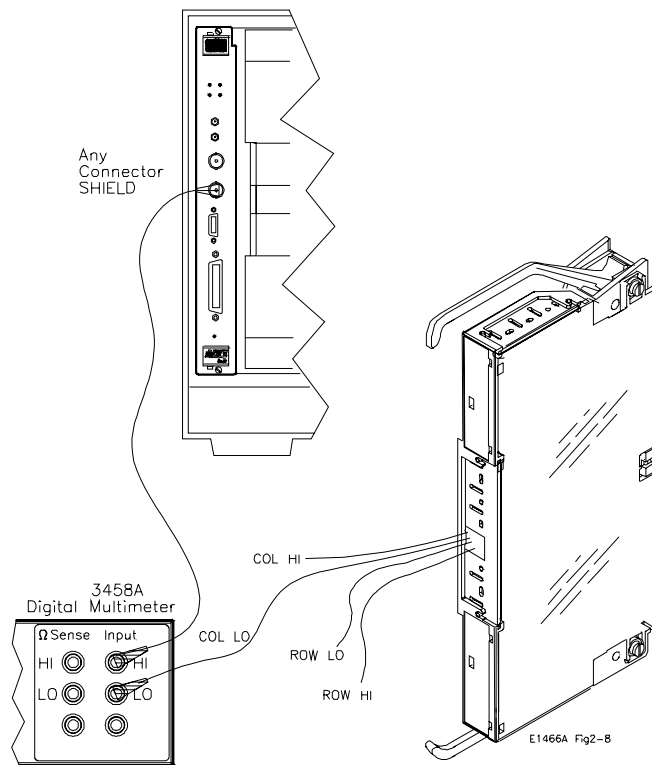


Figure 2-8. LO to Chassis Isolation Test Connections

5. Record the DMM reading in Table 2-1 (LO to Chassis)

```

10! RE-SAVE "DC_ISOL"
20 ASSIGN @Dmm TO 722
30 ASSIGN @Sw TO 70915
40 DISP CHR$(129)
50 DIM Cc$[2],Row$[2],Col$[2],A$[255],Conn$(2)[9],Value(2)
60 DATA COLUMN HI,COLUMN LO, CHASSIS
70 READ Conn$(*)
80 Cc$="01" ! Card number
90 OUTPUT @Dmm;"OHM 1E9"
100 PRINT "Equipment Connections "
110 PRINT
120 PRINT " 1. Turn mainframe and Agilent 3458A DMM power OFF"
130 PRINT " 2. Connect GPIB Cable from mainframe to DMM"
140 PRINT " 3. Install Component Assembly in Mainframe"
150 PRINT " 4. Attach Test Fixture to Component Assembly"
160 PRINT " 5. Turn Mainframe and Agilent 3458A power ON"
170 DISP "Press Continue when ready to begin testing "

```

```

180 PAUSE
190 OUTPUT @Sw;"*CLS"
200 OUTPUT @Sw;"SYST:CDES? "&Cc$
210 ENTER @Sw;A$
220 SELECT A$[2,2]
230 CASE "1"
240   Row$="15"
250   Col$="15"
260 CASE "4"
270   Row$="03"
280   Col$="63"
290 CASE "8"
300   Row$="07"
310   Col$="31"
320 CASE ELSE
330   PRINT "Wrong card type detected: ";A$
340   STOP
350 END SELECT
360 CLEAR SCREEN
370 !
380 !  Measure DC isolation HI to LO, HI to Chassis, and LO to Chassis
390 !
400 OUTPUT @Sw;"*RST"
410 OUTPUT @Sw;"CLOS (@"&Cc$&"0000:"&Cc$&Row$&Col$&")"
420 OUTPUT @Sw;"*OPC?"
430 ENTER @Sw;Opc
440 IF Opc <> 1 THEN 420
450 PRINT TABXY(1,1)," HI to LO DC Isolation Measurements"
460 PRINT TABXY(1,3)," 1.  Connect DMM Input HI lead to ";Conn$(0)
470 PRINT TABXY(1,4)," 2.  Connect DMM Input LO lead to ";Conn$(1)
480 DISP "Press Continue when connections are complete"
490 PAUSE
500 CLEAR SCREEN
510 OUTPUT @Dmm;"TRIG SGL"
520 ENTER @Dmm;Value(0)
530 PRINT TABXY(1,1)," HI to Chassis DC Isolation Measurements"
540 PRINT TABXY(1,3)," 1.  Connect DMM Input HI lead to ";Conn$(0)
550 PRINT TABXY(1,4)," 2.  Connect DMM Input LO lead to ";Conn$(2)
560 DISP "Press Continue when connections are complete"
570 PAUSE
580 CLEAR SCREEN
590 OUTPUT @Dmm;"TRIG SGL"
600 ENTER @Dmm;Value(1)

```

```

610 PRINT TABXY(1,1)," LO to Chassis DC Isolation Measurements"
620 PRINT TABXY(1,3)," 1. Connect DMM Input HI lead to ";Conn$(1)
630 PRINT TABXY(1,4)," 2. Connect DMM Input LO lead to ";Conn$(2)
640 DISP "Press Continue when connections are complete"
650 PAUSE
660 CLEAR SCREEN
670 OUTPUT @Dmm;"TRIG SGL"
680 ENTER @Dmm;Value(2)
690 OUTPUT @Sw;"OPEN (@ "&Cc$&"0000:"&Cc$&Row$&Col$&")"
700 PRINT "DC Isolation Tests Complete"
710 DISP "Press continue to print measurement results"
720 PAUSE
730 CLEAR SCREEN
740 PRINT TABXY(1,1), "DC Isolation Tests"
750 PRINT TABXY(1,3), "HI to LO (Ohms)      ";Value(0)
760 PRINT TABXY(1,4), "HI to Chassis (Ohms) ";Value(1)
770 PRINT TABXY(1,5), "LO to Chassis (Ohms) ";Value(2)
780 END

```

Example: This example performs DC Isolation Tests for HI to LO, HI to Chassis, and LO to chassis

Typical Result

DC Isolation Tests	
HI to LO (Ohms)	1E+38
HI to Chassis (Ohms)	1E+38
LO to Chassis (Ohms)	1E+38

Performance Test Record

Table 2-1 is a form you can copy and use to record performance verification test results for the matrix module. Information concerning test limits, measurement uncertainty, and test accuracy ratio (TAR) is provided below.

Test Limits

Test limits are defined for Closed Channel Resistance Test and DC Isolation Test using the specifications in Appendix A of the *Agilent E1465A/E1466A/E1467A Relay Matrix Switch Modules User's Manual*. The specifications are single-sided, (i.e., there is an upper limit or a lower limit, but not both). In the Performance Test Record, the Minimum or Maximum column will be blank.

Measurement Uncertainty

For the performance verification tests in this manual, measurement uncertainties are calculated based on the Agilent 3458A Digital Multimeter. The measurement uncertainty shown in Table 2-2 is the accuracy of the Agilent 3458A using 90-day specifications. The calculations follow.

Closed Channel Resistance Test

Conditions:

- 4-wire ohms function, 10 Ω range
- 90-day specifications
- Worst-case reading = 2.7 Ω

$$\begin{aligned}\text{M.U.} &= (15 \text{ ppm of Reading} + 5 \text{ ppm of Range}) \\ &= (15 \times 10^{-6} * 2.7) + (5 \times 10^{-6} * 10) \Omega \\ &= 9.05 \times 10^{-5} \Omega\end{aligned}$$

DC Isolation Test

Conditions:

- 2-wire ohms function, 1 G Ω range
- 90-day specifications
- Worst-case reading = 1.2 G Ω (highest resistance that can be measured with the Agilent 3458A)

$$\begin{aligned}\text{M.U.} &= (0.5\% \text{ of Reading} + 10 \text{ ppm of Range}) \\ &= (0.005 * 1.2 \times 10^9) + (10 \times 10^{-6} * 1 \times 10^9) \Omega \\ &= 6.01 \times 10^6 \Omega\end{aligned}$$

Test Accuracy Ratio (TAR)

Test Accuracy Ratios are not defined for single-sided measurements, so all measurements have 'NA' (Not Applicable) in the TAR column.

Table 2-1. Performance Test Record (Page 1 of 10)

Model _____ Report No. _____ Date _____

General Information

Test Facility:

Name

Report No. _____

Date _____

Address

Customer

City/State

Tested by

Phone

Special Notes:

Test Equipment Record

Test Equipment Used: Description	Model No.	Trace No.	Cal Due Date
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____

Table 2-1. Performance Test Record (Page 2 of 10)

Model _____			Report No. _____		Date _____			
Test No/Description			Minimum* Value	Measured Value		Maximum Value	Meas Uncert	Test Acc Ratio (TAR)
Test 2-1: Closed Contact Resistance (values in ohms)								
E1465A	E1466A	E1467A		HI Path	LO Path			
R00 C00	R00 C00	R00 C00		_____	_____	2.7	9.050E-5	NA
R00 C01	R00 C01	R00 C01		_____	_____	2.7	9.050E-5	NA
R00 C02	R00 C02	R00 C02		_____	_____	2.7	9.050E-5	NA
R00 C03	R00 C03	R00 C03		_____	_____	2.7	9.050E-5	NA
R00 C04	R00 C04	R00 C04		_____	_____	2.7	9.050E-5	NA
R00 C05	R00 C05	R00 C05		_____	_____	2.7	9.050E-5	NA
R00 C06	R00 C06	R00 C06		_____	_____	2.7	9.050E-5	NA
R00 C07	R00 C07	R00 C07		_____	_____	2.7	9.050E-5	NA
R00 C08	R00 C08	R00 C08		_____	_____	2.7	9.050E-5	NA
R00 C09	R00 C09	R00 C09		_____	_____	2.7	9.050E-5	NA
R00 C10	R00 C10	R00 C10		_____	_____	2.7	9.050E-5	NA
R00 C11	R00 C11	R00 C11		_____	_____	2.7	9.050E-5	NA
R00 C12	R00 C12	R00 C12		_____	_____	2.7	9.050E-5	NA
R00 C13	R00 C13	R00 C13		_____	_____	2.7	9.050E-5	NA
R00 C14	R00 C14	R00 C14		_____	_____	2.7	9.050E-5	NA
R00 C15	R00 C15	R00 C15		_____	_____	2.7	9.050E-5	NA
R01 C00	R00 C16	R00 C16		_____	_____	2.7	9.050E-5	NA
R01 C01	R00 C17	R00 C17		_____	_____	2.7	9.050E-5	NA
R01 C02	R00 C18	R00 C18		_____	_____	2.7	9.050E-5	NA
R01 C03	R00 C19	R00 C19		_____	_____	2.7	9.050E-5	NA
R01 C04	R00 C20	R00 C20		_____	_____	2.7	9.050E-5	NA
R01 C05	R00 C21	R00 C21		_____	_____	2.7	9.050E-5	NA
R01 C06	R00 C22	R00 C22		_____	_____	2.7	9.050E-5	NA
R01 C07	R00 C23	R00 C23		_____	_____	2.7	9.050E-5	NA
R01 C08	R00 C24	R00 C24		_____	_____	2.7	9.050E-5	NA
R01 C09	R00 C25	R00 C25		_____	_____	2.7	9.050E-5	NA
R01 C10	R00 C26	R00 C26		_____	_____	2.7	9.050E-5	NA
R01 C11	R00 C27	R00 C27		_____	_____	2.7	9.050E-5	NA
R01 C12	R00 C28	R00 C28		_____	_____	2.7	9.050E-5	NA
R01 C13	R00 C29	R00 C29		_____	_____	2.7	9.050E-5	NA
R01 C14	R00 C30	R00 C30		_____	_____	2.7	9.050E-5	NA
R01 C15	R00 C31	R00 C31		_____	_____	2.7	9.050E-5	NA

*Single-sided specification - Minimum value does not apply

Table 2-1. Performance Test Record (Page 3 of 10)

Model _____		Report No. _____		Date _____	
--------------------	--	-------------------------	--	-------------------	--

Test No/Description			Minimum* Value	Measured Value	Maximum Value	Meas Uncert	Test Acc Ratio (TAR)
Test 2-1: Closed Contact Resistance (Continued) (values in ohms)							
E1465A	E1466A	E1467A		HI Path	LO Path		
R02 C00	R00 C32	R01 C00		_____	_____	2.7	9.050E-5
R02 C01	R00 C33	R01 C01		_____	_____	2.7	9.050E-5
R02 C02	R00 C34	R01 C02		_____	_____	2.7	9.050E-5
R02 C03	R00 C35	R01 C03		_____	_____	2.7	9.050E-5
R02 C04	R00 C36	R01 C04		_____	_____	2.7	9.050E-5
R02 C05	R00 C37	R01 C05		_____	_____	2.7	9.050E-5
R02 C06	R00 C38	R01 C06		_____	_____	2.7	9.050E-5
R02 C07	R00 C39	R01 C07		_____	_____	2.7	9.050E-5
R02 C08	R00 C40	R01 C08		_____	_____	2.7	9.050E-5
R02 C09	R00 C41	R01 C09		_____	_____	2.7	9.050E-5
R02 C10	R00 C42	R01 C10		_____	_____	2.7	9.050E-5
R02 C11	R00 C43	R01 C11		_____	_____	2.7	9.050E-5
R02 C12	R00 C44	R01 C12		_____	_____	2.7	9.050E-5
R02 C13	R00 C45	R01 C13		_____	_____	2.7	9.050E-5
R02 C14	R00 C46	R01 C14		_____	_____	2.7	9.050E-5
R02 C15	R00 C47	R01 C15		_____	_____	2.7	9.050E-5
R03 C00	R00 C48	R01 C16		_____	_____	2.7	9.050E-5
R03 C01	R00 C49	R01 C17		_____	_____	2.7	9.050E-5
R03 C02	R00 C50	R01 C18		_____	_____	2.7	9.050E-5
R03 C03	R00 C51	R01 C19		_____	_____	2.7	9.050E-5
R03 C04	R00 C52	R01 C20		_____	_____	2.7	9.050E-5
R03 C05	R00 C53	R01 C21		_____	_____	2.7	9.050E-5
R03 C06	R00 C54	R01 C22		_____	_____	2.7	9.050E-5
R03 C07	R00 C55	R01 C23		_____	_____	2.7	9.050E-5
R03 C08	R00 C56	R01 C24		_____	_____	2.7	9.050E-5
R03 C09	R00 C57	R01 C25		_____	_____	2.7	9.050E-5
R03 C10	R00 C58	R01 C26		_____	_____	2.7	9.050E-5
R03 C11	R00 C59	R01 C27		_____	_____	2.7	9.050E-5
R03 C12	R00 C60	R01 C28		_____	_____	2.7	9.050E-5
R03 C13	R00 C61	R01 C29		_____	_____	2.7	9.050E-5
R03 C14	R00 C62	R01 C30		_____	_____	2.7	9.050E-5
R03 C15	R00 C63	R01 C31		_____	_____	2.7	9.050E-5

*Single-sided specification - Minimum value does not apply

Table 2-1. Performance Test Record (Page 4 of 10)

Model _____			Report No. _____		Date _____			
Test No/Description			Minimum* Value	Measured Value		Maximum Value	Meas Uncert	Test Acc Ratio (TAR)
Test 2-1: Closed Contact Resistance (Continued) (values in ohms)								
E1465A	E1466A	E1467A		HI Path	LO Path			
R04 C00	R01 C00	R02 C00		_____	_____	2.7	9.050E-5	NA
R04 C01	R01 C01	R02 C01		_____	_____	2.7	9.050E-5	NA
R04 C02	R01 C02	R02 C02		_____	_____	2.7	9.050E-5	NA
R04 C03	R01 C03	R02 C03		_____	_____	2.7	9.050E-5	NA
R04 C04	R01 C04	R02 C04		_____	_____	2.7	9.050E-5	NA
R04 C05	R01 C05	R02 C05		_____	_____	2.7	9.050E-5	NA
R04 C06	R01 C06	R02 C06		_____	_____	2.7	9.050E-5	NA
R04 C07	R01 C07	R02 C07		_____	_____	2.7	9.050E-5	NA
R04 C08	R01 C08	R02 C08		_____	_____	2.7	9.050E-5	NA
R04 C09	R01 C09	R02 C09		_____	_____	2.7	9.050E-5	NA
R04 C10	R01 C10	R02 C10		_____	_____	2.7	9.050E-5	NA
R04 C11	R01 C11	R02 C11		_____	_____	2.7	9.050E-5	NA
R04 C12	R01 C12	R02 C12		_____	_____	2.7	9.050E-5	NA
R04 C13	R01 C13	R02 C13		_____	_____	2.7	9.050E-5	NA
R04 C14	R01 C14	R02 C14		_____	_____	2.7	9.050E-5	NA
R04 C15	R01 C15	R02 C15		_____	_____	2.7	9.050E-5	NA
R05 C00	R01 C16	R02 C16		_____	_____	2.7	9.050E-5	NA
R05 C01	R01 C17	R02 C17		_____	_____	2.7	9.050E-5	NA
R05 C02	R01 C18	R02 C18		_____	_____	2.7	9.050E-5	NA
R05 C03	R01 C19	R02 C19		_____	_____	2.7	9.050E-5	NA
R05 C04	R01 C20	R02 C20		_____	_____	2.7	9.050E-5	NA
R05 C05	R01 C21	R02 C21		_____	_____	2.7	9.050E-5	NA
R05 C06	R01 C22	R02 C22		_____	_____	2.7	9.050E-5	NA
R05 C07	R01 C23	R02 C23		_____	_____	2.7	9.050E-5	NA
R05 C08	R01 C24	R02 C24		_____	_____	2.7	9.050E-5	NA
R05 C09	R01 C25	R02 C25		_____	_____	2.7	9.050E-5	NA
R05 C10	R01 C26	R02 C26		_____	_____	2.7	9.050E-5	NA
R05 C11	R01 C27	R02 C27		_____	_____	2.7	9.050E-5	NA
R05 C12	R01 C28	R02 C28		_____	_____	2.7	9.050E-5	NA
R05 C13	R01 C29	R02 C29		_____	_____	2.7	9.050E-5	NA
R05 C14	R01 C30	R02 C30		_____	_____	2.7	9.050E-5	NA
R05 C15	R01 C31	R02 C31		_____	_____	2.7	9.050E-5	NA

*Single-sided specification - Minimum value does not apply

Table 2-1. Performance Test Record (Page 5 of 10)

Model _____			Report No. _____		Date _____			
Test No/Description			Minimum* Value	Measured Value		Maximum Value	Meas Uncert	Test Acc Ratio (TAR)
Test 2-1: Closed Contact Resistance (Continued) (values in ohms)								
E1465A	E1466A	E1467A		HI Path	LO Path			
R06 C00	R01 C32	R03 C00		_____	_____	2.7	9.050E-5	NA
R06 C01	R01 C33	R03 C01		_____	_____	2.7	9.050E-5	NA
R06 C02	R01 C34	R03 C02		_____	_____	2.7	9.050E-5	NA
R06 C03	R01 C35	R03 C03		_____	_____	2.7	9.050E-5	NA
R06 C04	R01 C36	R03 C04		_____	_____	2.7	9.050E-5	NA
R06 C05	R01 C37	R03 C05		_____	_____	2.7	9.050E-5	NA
R06 C06	R01 C38	R03 C06		_____	_____	2.7	9.050E-5	NA
R06 C07	R01 C39	R03 C07		_____	_____	2.7	9.050E-5	NA
R06 C08	R01 C40	R03 C08		_____	_____	2.7	9.050E-5	NA
R06 C09	R01 C41	R03 C09		_____	_____	2.7	9.050E-5	NA
R06 C10	R01 C42	R03 C10		_____	_____	2.7	9.050E-5	NA
R06 C11	R01 C43	R03 C11		_____	_____	2.7	9.050E-5	NA
R06 C12	R01 C44	R03 C12		_____	_____	2.7	9.050E-5	NA
R06 C13	R01 C45	R03 C13		_____	_____	2.7	9.050E-5	NA
R06 C14	R01 C46	R03 C14		_____	_____	2.7	9.050E-5	NA
R06 C15	R01 C47	R03 C15		_____	_____	2.7	9.050E-5	NA
R07 C00	R01 C48	R03 C16		_____	_____	2.7	9.050E-5	NA
R07 C01	R01 C49	R03 C17		_____	_____	2.7	9.050E-5	NA
R07 C02	R01 C50	R03 C18		_____	_____	2.7	9.050E-5	NA
R07 C03	R01 C51	R03 C19		_____	_____	2.7	9.050E-5	NA
R07 C04	R01 C52	R03 C20		_____	_____	2.7	9.050E-5	NA
R07 C05	R01 C53	R03 C21		_____	_____	2.7	9.050E-5	NA
R07 C06	R01 C54	R03 C22		_____	_____	2.7	9.050E-5	NA
R07 C07	R01 C55	R03 C23		_____	_____	2.7	9.050E-5	NA
R07 C08	R01 C56	R03 C24		_____	_____	2.7	9.050E-5	NA
R07 C09	R01 C57	R03 C25		_____	_____	2.7	9.050E-5	NA
R07 C10	R01 C58	R03 C26		_____	_____	2.7	9.050E-5	NA
R07 C11	R01 C59	R03 C27		_____	_____	2.7	9.050E-5	NA
R07 C12	R01 C60	R03 C28		_____	_____	2.7	9.050E-5	NA
R07 C13	R01 C61	R03 C29		_____	_____	2.7	9.050E-5	NA
R07 C14	R01 C62	R03 C30		_____	_____	2.7	9.050E-5	NA
R07 C15	R01 C63	R03 C31		_____	_____	2.7	9.050E-5	NA

*Single-sided specification - Minimum value does not apply

Table 2-1. Performance Test Record (Page 6 of 10)

Model _____		Report No. _____		Date _____	
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Test No/Description			Minimum* Value	Measured Value	Maximum Value	Meas Uncert	Test Acc Ratio (TAR)
Test 2-1: Closed Contact Resistance (Continued) (values in ohms)							
E1465A	E1466A	E1467A		HI Path	LO Path		
R08 C00	R02 C00	R04 C00		_____	_____	2.7	9.050E-5
R08 C01	R02 C01	R04 C01		_____	_____	2.7	9.050E-5
R08 C02	R02 C02	R04 C02		_____	_____	2.7	9.050E-5
R08 C03	R02 C03	R04 C03		_____	_____	2.7	9.050E-5
R08 C04	R02 C04	R04 C04		_____	_____	2.7	9.050E-5
R08 C05	R02 C05	R04 C05		_____	_____	2.7	9.050E-5
R08 C06	R02 C06	R04 C06		_____	_____	2.7	9.050E-5
R08 C07	R02 C07	R04 C07		_____	_____	2.7	9.050E-5
R08 C08	R02 C08	R04 C08		_____	_____	2.7	9.050E-5
R08 C09	R02 C09	R04 C09		_____	_____	2.7	9.050E-5
R08 C10	R02 C10	R04 C10		_____	_____	2.7	9.050E-5
R08 C11	R02 C11	R04 C11		_____	_____	2.7	9.050E-5
R08 C12	R02 C12	R04 C12		_____	_____	2.7	9.050E-5
R08 C13	R02 C13	R04 C13		_____	_____	2.7	9.050E-5
R08 C14	R02 C14	R04 C14		_____	_____	2.7	9.050E-5
R08 C15	R02 C15	R04 C15		_____	_____	2.7	9.050E-5
R09 C00	R02 C16	R04 C16		_____	_____	2.7	9.050E-5
R09 C01	R02 C17	R04 C17		_____	_____	2.7	9.050E-5
R09 C02	R02 C18	R04 C18		_____	_____	2.7	9.050E-5
R09 C03	R02 C19	R04 C19		_____	_____	2.7	9.050E-5
R09 C04	R02 C20	R04 C20		_____	_____	2.7	9.050E-5
R09 C05	R02 C21	R04 C21		_____	_____	2.7	9.050E-5
R09 C06	R02 C22	R04 C22		_____	_____	2.7	9.050E-5
R09 C07	R02 C23	R04 C23		_____	_____	2.7	9.050E-5
R09 C08	R02 C24	R04 C24		_____	_____	2.7	9.050E-5
R09 C09	R02 C25	R04 C25		_____	_____	2.7	9.050E-5
R09 C10	R02 C26	R04 C26		_____	_____	2.7	9.050E-5
R09 C11	R02 C27	R04 C27		_____	_____	2.7	9.050E-5
R09 C12	R02 C28	R04 C28		_____	_____	2.7	9.050E-5
R09 C13	R02 C29	R04 C29		_____	_____	2.7	9.050E-5
R09 C14	R02 C30	R04 C30		_____	_____	2.7	9.050E-5
R09 C15	R02 C31	R04 C31		_____	_____	2.7	9.050E-5

*Single-sided specification - Minimum value does not apply

Table 2-1. Performance Test Record (Page 7 of 10)

Model _____		Report No. _____		Date _____	
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Test No/Description			Minimum* Value	Measured Value	Maximum Value	Meas Uncert	Test Acc Ratio (TAR)
Test 2-1: Closed Contact Resistance (Continued) (values in ohms)							
E1465A	E1466A	E1467A		HI Path	LO Path		
R10 C00	R02 C32	R05 C00		_____	_____	2.7	9.050E-5
R10 C01	R02 C33	R05 C01		_____	_____	2.7	9.050E-5
R10 C02	R02 C34	R05 C02		_____	_____	2.7	9.050E-5
R10 C03	R02 C35	R05 C03		_____	_____	2.7	9.050E-5
R10 C04	R02 C36	R05 C04		_____	_____	2.7	9.050E-5
R10 C05	R02 C37	R05 C05		_____	_____	2.7	9.050E-5
R10 C06	R02 C38	R05 C06		_____	_____	2.7	9.050E-5
R10 C07	R02 C39	R05 C07		_____	_____	2.7	9.050E-5
R10 C08	R02 C40	R05 C08		_____	_____	2.7	9.050E-5
R10 C09	R02 C41	R05 C09		_____	_____	2.7	9.050E-5
R10 C10	R02 C42	R05 C10		_____	_____	2.7	9.050E-5
R10 C11	R02 C43	R05 C11		_____	_____	2.7	9.050E-5
R10 C12	R02 C44	R05 C12		_____	_____	2.7	9.050E-5
R10 C13	R02 C45	R05 C13		_____	_____	2.7	9.050E-5
R10 C14	R02 C46	R05 C14		_____	_____	2.7	9.050E-5
R10 C15	R02 C47	R05 C15		_____	_____	2.7	9.050E-5
R11 C00	R02 C48	R05 C16		_____	_____	2.7	9.050E-5
R11 C01	R02 C49	R05 C17		_____	_____	2.7	9.050E-5
R11 C02	R02 C50	R05 C18		_____	_____	2.7	9.050E-5
R11 C03	R02 C51	R05 C19		_____	_____	2.7	9.050E-5
R11 C04	R02 C52	R05 C20		_____	_____	2.7	9.050E-5
R11 C05	R02 C53	R05 C21		_____	_____	2.7	9.050E-5
R11 C06	R02 C54	R05 C22		_____	_____	2.7	9.050E-5
R11 C07	R02 C55	R05 C23		_____	_____	2.7	9.050E-5
R11 C08	R02 C56	R05 C24		_____	_____	2.7	9.050E-5
R11 C09	R02 C57	R05 C25		_____	_____	2.7	9.050E-5
R11 C10	R02 C58	R05 C26		_____	_____	2.7	9.050E-5
R11 C11	R02 C59	R05 C27		_____	_____	2.7	9.050E-5
R11 C12	R02 C60	R05 C28		_____	_____	2.7	9.050E-5
R11 C13	R02 C61	R05 C29		_____	_____	2.7	9.050E-5
R11 C14	R02 C62	R05 C30		_____	_____	2.7	9.050E-5
R11 C15	R02 C63	R05 C31		_____	_____	2.7	9.050E-5

*Single-sided specification - Minimum value does not apply

Table 2-1. Performance Test Record (Page 8 of 10)

Model _____			Report No. _____		Date _____			
Test No/Description			Minimum* Value	Measured Value		Maximum Value	Meas Uncert	Test Acc Ratio (TAR)
Test 2-1: Closed Contact Resistance (Continued) (values in ohms)								
E1465A	E1466A	E1467A		HI Path	LO Path			
R12 C00	R03 C00	R06 C00		_____	_____	2.7	9.050E-5	NA
R12 C01	R03 C01	R06 C01		_____	_____	2.7	9.050E-5	NA
R12 C02	R03 C02	R06 C02		_____	_____	2.7	9.050E-5	NA
R12 C03	R03 C03	R06 C03		_____	_____	2.7	9.050E-5	NA
R12 C04	R03 C04	R06 C04		_____	_____	2.7	9.050E-5	NA
R12 C05	R03 C05	R06 C05		_____	_____	2.7	9.050E-5	NA
R12 C06	R03 C06	R06 C06		_____	_____	2.7	9.050E-5	NA
R12 C07	R03 C07	R06 C07		_____	_____	2.7	9.050E-5	NA
R12 C08	R03 C08	R06 C08		_____	_____	2.7	9.050E-5	NA
R12 C09	R03 C09	R06 C09		_____	_____	2.7	9.050E-5	NA
R12 C10	R03 C10	R06 C10		_____	_____	2.7	9.050E-5	NA
R12 C11	R03 C11	R06 C11		_____	_____	2.7	9.050E-5	NA
R12 C12	R03 C12	R06 C12		_____	_____	2.7	9.050E-5	NA
R12 C13	R03 C13	R06 C13		_____	_____	2.7	9.050E-5	NA
R12 C14	R03 C14	R06 C14		_____	_____	2.7	9.050E-5	NA
R12 C15	R03 C15	R06 C15		_____	_____	2.7	9.050E-5	NA
R13 C00	R03 C16	R06 C16		_____	_____	2.7	9.050E-5	NA
R13 C01	R03 C17	R06 C17		_____	_____	2.7	9.050E-5	NA
R13 C02	R03 C18	R06 C18		_____	_____	2.7	9.050E-5	NA
R13 C03	R03 C19	R06 C19		_____	_____	2.7	9.050E-5	NA
R13 C04	R03 C20	R06 C20		_____	_____	2.7	9.050E-5	NA
R13 C05	R03 C21	R06 C21		_____	_____	2.7	9.050E-5	NA
R13 C06	R03 C22	R06 C22		_____	_____	2.7	9.050E-5	NA
R13 C07	R03 C23	R06 C23		_____	_____	2.7	9.050E-5	NA
R13 C08	R03 C24	R06 C24		_____	_____	2.7	9.050E-5	NA
R13 C09	R03 C25	R06 C25		_____	_____	2.7	9.050E-5	NA
R13 C10	R03 C26	R06 C26		_____	_____	2.7	9.050E-5	NA
R13 C11	R03 C27	R06 C27		_____	_____	2.7	9.050E-5	NA
R13 C12	R03 C28	R06 C28		_____	_____	2.7	9.050E-5	NA
R13 C13	R03 C29	R06 C29		_____	_____	2.7	9.050E-5	NA
R13 C14	R03 C30	R06 C30		_____	_____	2.7	9.050E-5	NA
R13 C15	R03 C31	R06 C31		_____	_____	2.7	9.050E-5	NA

*Single-sided specification - Minimum value does not apply

Table 2-1. Performance Test Record (Page 9 of 10)

Model _____			Report No. _____		Date _____			
Test No/Description			Minimum* Value	Measured Value		Maximum Value	Meas Uncert	Test Acc Ratio (TAR)
Test 2-1: Closed Contact Resistance (Continued) (values in ohms)								
E1465A	E1466A	E1467A		HI Path	LO Path			
R14 C00	R03 C32	R07 C00		_____	_____	2.7	9.050E-5	NA
R14 C01	R03 C33	R07 C01		_____	_____	2.7	9.050E-5	NA
R14 C02	R03 C34	R07 C02		_____	_____	2.7	9.050E-5	NA
R14 C03	R03 C35	R07 C03		_____	_____	2.7	9.050E-5	NA
R14 C04	R03 C36	R07 C04		_____	_____	2.7	9.050E-5	NA
R14 C05	R03 C37	R07 C05		_____	_____	2.7	9.050E-5	NA
R14 C06	R03 C38	R07 C06		_____	_____	2.7	9.050E-5	NA
R14 C07	R03 C39	R07 C07		_____	_____	2.7	9.050E-5	NA
R14 C08	R03 C40	R07 C08		_____	_____	2.7	9.050E-5	NA
R14 C09	R03 C41	R07 C09		_____	_____	2.7	9.050E-5	NA
R14 C10	R03 C42	R07 C10		_____	_____	2.7	9.050E-5	NA
R14 C11	R03 C43	R07 C11		_____	_____	2.7	9.050E-5	NA
R14 C12	R03 C44	R07 C12		_____	_____	2.7	9.050E-5	NA
R14 C13	R03 C45	R07 C13		_____	_____	2.7	9.050E-5	NA
R14 C14	R03 C46	R07 C14		_____	_____	2.7	9.050E-5	NA
R14 C15	R03 C47	R07 C15		_____	_____	2.7	9.050E-5	NA
R15 C00	R03 C48	R07 C16		_____	_____	2.7	9.050E-5	NA
R15 C01	R03 C49	R07 C17		_____	_____	2.7	9.050E-5	NA
R15 C02	R03 C50	R07 C18		_____	_____	2.7	9.050E-5	NA
R15 C03	R03 C51	R07 C19		_____	_____	2.7	9.050E-5	NA
R15 C04	R03 C52	R07 C20		_____	_____	2.7	9.050E-5	NA
R15 C05	R03 C53	R07 C21		_____	_____	2.7	9.050E-5	NA
R15 C06	R03 C54	R07 C22		_____	_____	2.7	9.050E-5	NA
R15 C07	R03 C55	R07 C23		_____	_____	2.7	9.050E-5	NA
R15 C08	R03 C56	R07 C24		_____	_____	2.7	9.050E-5	NA
R15 C09	R03 C57	R07 C25		_____	_____	2.7	9.050E-5	NA
R15 C10	R03 C58	R07 C26		_____	_____	2.7	9.050E-5	NA
R15 C11	R03 C59	R07 C27		_____	_____	2.7	9.050E-5	NA
R15 C12	R03 C60	R07 C28		_____	_____	2.7	9.050E-5	NA
R15 C13	R03 C61	R07 C29		_____	_____	2.7	9.050E-5	NA
R15 C14	R03 C62	R07 C30		_____	_____	2.7	9.050E-5	NA
R15 C15	R03 C63	R07 C31		_____	_____	2.7	9.050E-5	NA

*Single-sided specification - Minimum value does not apply

Table 2-1. Performance Test Record (Page 10 of 10)

Model _____ Report No. _____ Date _____					
Test No/Description	Minimum Value	Measured Value	Maximum* Value	Meas Uncert	Test Acc Ratio (TAR)
Test 2-2 DC Isolation (values in ohms)					
HI to LO	1.2E9	_____		6.01E6	NA
HI to Chassis	1.2E9	_____		6.01E6	NA
LO to Chassis	1.2E9	_____		6.01E6	NA

* Single-sided specification - Maximum value does not apply

Chapter 3

Replaceable Parts

Introduction

This chapter contains information for ordering replaceable parts for the Agilent E1465A/E1466A/E1467A Relay Matrixes.

Ordering Information

To order a part listed in this chapter, specify the Agilent Technologies part number and the quantity required. Send the order to your nearest Agilent Technologies Sales and Support Office.

Replaceable Parts Lists

Table 3-1. Component Assembly Replaceable Parts

Reference Designator	Agilent Part Number	Qty	Part Description
A2		1	MOD - HI DENSITY MATRIX (See Figure 3-1)
MP1	E1400-45102†	1	HANDLE -BOTTOM METAL INJECTION
MP2	E1400-45101†	1	HANDLE -TOP METAL INJECTION
MP3	8160-0686	1	RFI STRIP-FINGERS BE-CU TIN-PLATED
PNL1	E1466-00202†	1	PANEL-FRONT
SCR1-SCR2	E1400-00610†	2	SHOULDER SCREW ASSY
SCR3-SCR8	0515-1135	8	SCREW-MACHINE M3 X 0.5 25MM-LG FLAT-HD
SCR13	0515-1375		SCREW-MACHINE M2.5 X 0.45 6MM-LG FLAT-HD
SCR14-SCR15	0515-1135		SCREW-MACHINE M3 X 0.5 25MM-LG FLAT-HD
SHD1	E1466-00601	1	SHIELD-TOP
SHD2	E1466-00602	1	SHIELD-BOTTOM
† NOTE: For modules with serial numbers below 3126A00445 (E1465A), 3126A01090 (E1466A), or 3126A01109 (E1467A), the following parts must be used for replacement (see inset in figure 3-1).			
*A2	E1466-66201	1	MOD - HI DENSITY MATRIX (See Figure 3-1)
*MP1	E1400-84105	1	EXT HANDLE KIT-BOTTOM
*MP2	E1400-84106	1	EXT HANDLE KIT-TOP
*PNL1	E1466-00201	1	PANEL-FRONT
*SCR1-*SCR2	0515-0368	2	SCREW-MACHINE ASSY M2.5 X 12MM-LG PH
*SCR9-*SCR10	0515-1375	3	SCREW-MACHINE M2.5 X 0.45 6MM-LG FLAT-HD
*SCR11-*SCR12	0515-1968	2	SCREW PH M2.5 X 11TX

Table 3-1. Component Assembly Replaceable Parts (Continued)

Reference Designator	Agilent Part Number	Qty	Part Description
A2A1	E1466-66501	1	PC ASSEMBLY DENSE MATRIX
C101-C106	0160-4835	15	CAPACITOR-FXD 0.1uF +-10% 50 V
C107-C110	0160-4832	9	CAPACITOR-FXD 0.01uF +-10% 100 V
C111	0160-4835		CAPACITOR-FXD 0.1uF +-10% 50 V
C201	0160-4835		CAPACITOR-FXD 0.1uF +-10% 50 V
C202	0160-4832		CAPACITOR-FXD 0.01uF +-10% 100 V
C203	0160-4835		CAPACITOR-FXD 0.1uF +-10% 50 V
C301	0180-0161	4	CAPACITOR-FXD 3.3uF +-10% 35 V
C302-C303	0160-4832		CAPACITOR-FXD 0.01uF +-10% 100 V
C304	0180-0161		CAPACITOR-FXD 3.3uF +-10% 35 V
C305	0160-4832		CAPACITOR-FXD 0.01uF +-10% 100 V
C306	0160-4835		CAPACITOR-FXD 0.1uF +-10% 50 V
C307	0160-4832		CAPACITOR-FXD 0.01uF +-10% 100 V
C308-C309	0180-0161		CAPACITOR-FXD 3.3uF +-10% 35 V
C401-C405	0160-4835		CAPACITOR-FXD 0.1uF +-10% 50 V
C1301-C1302	0180-1746	2	CAPACITOR-FXD 15uF +-10% 20 V
CR201	1901-1098	1	DIODE-SWITCHING 50V 200MA 4NS
CR301-CR312	1902-0594	24	DIODE-ZENER 18V 5% PD=1W IR=5UA
CR401-CR412	1902-0594		DIODE-ZENER 18V 5% PD=1W IR=5UA
CR501-CR564	1902-1597	512	DIODE-ZENER 18V 5% DO-35 PD=.5W
CR601-CR664	1902-1597		DIODE-ZENER 18V 5% DO-35 PD=.5W
CR701-CR764	1902-1597		DIODE-ZENER 18V 5% DO-35 PD=.5W
CR801-CR864	1902-1597		DIODE-ZENER 18V 5% DO-35 PD=.5W
CR901-CR964	1902-1597		DIODE-ZENER 18V 5% DO-35 PD=.5W
CR1001-CR1064	1902-1597		DIODE-ZENER 18V 5% DO-35 PD=.5W
CR1101-CR1164	1902-1597		DIODE-ZENER 18V 5% DO-35 PD=.5W
CR1201-CR1264	1902-1597		DIODE-ZENER 18V 5% DO-35 PD=.5W
F1301-F1302	2110-0712	2	FUSE-SUBMINIATURE 4A 125V NTD AX
J1-J2	1252-1596	3	CONNECTOR-POST TYPE 2.54-PIN-SPCG 96-CONTACT
J101	1251-4927	2	CONNECTOR-POST TYPE .100-PIN-SPCG 16-CONTACT
J201	1251-4927		CONNECTOR-POST TYPE .100-PIN-SPCG 16-CONTACT
JMP1	1258-0247	1	JUMPER-4 POSITIONS HOUSING MATERIAL
K0-K15	0490-1782	256	RELAY 2C 12VDC-COIL 1A 250VDC
K100-K115	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
K200-K215	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
K300-K315	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
K400-K415	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
K500-K515	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
K600-K615	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
K700-K715	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC

Table 3-1. Component Assembly Replaceable Parts (Continued)

Reference Designator	Agilent Part Number	Qty	Part Description
K800-K815	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
K900-K915	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
K1000-K1015	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
K1100-K1115	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
K1200-K1215	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
K1300-K1315	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
K1400-K1415	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
K1500-K1515	0490-1782		RELAY 2C 12VDC-COIL 1A 250VDC
L1301-L1302	9140-1354	2	INDUCTOR-FIXED 47UH +-15% .453D-INX.9LG-IN
P1	1252-1596		CONNECTOR-POST TYPE 2.54-PIN-SPCG 96-CONTACT
P2	1252-4743	1	CONNECTOR-POST TYPE 2.54-PIN-SPCG 64-CONTACT
Q301-Q308	1855-0567	16	TRANSISTOR MOSFET P-CHAN E-MODE SI
Q401-Q408	1855-0567		TRANSISTOR MOSFET P-CHAN E-MODE SI
R101	0757-0421	1	RESISTOR 825 +-1% .125W TF TC=0+-100
R102-R105	0757-0472	4	RESISTOR 200K +-1% .125W TF TC=0+-100
R106-R109	0757-0442	4	RESISTOR 10K +-1% .125W TF TC=0+-100
R201	0698-4501	1	RESISTOR 59K +-1% .125W TF TC=0+-100
R202	0757-0465	1	RESISTOR 100K +-1% .125W TF TC=0+-100
R203	0757-0453	1	RESISTOR 30.1K +-1% .125W TF TC=0+-100
R204	0757-0417	1	RESISTOR 562 +-1% .125W TF TC=0+-100
R301	0698-4444	1	RESISTOR 4.87K +-1% .125W TF TC=0+-100
RP101-RP104	1810-0279	6	NETWORK-RES 10-SIP 4.7K OHM X 9
RP301	1810-0265	6	NETWORK-RES 16-DIP 680.0 OHM X 8
RP302-RP303	1810-0280	8	NETWORK-RES 10-SIP 10.0K OHM X 9
RP304-RP305	1810-0265		NETWORK-RES 16-DIP 680.0 OHM X 8
RP306-RP307	1810-0280		NETWORK-RES 10-SIP 10.0K OHM X 9
RP308	1810-0279		NETWORK-RES 10-SIP 4.7K OHM X 9
RP401	1810-0265		NETWORK-RES 16-DIP 680.0 OHM X 8
RP402-RP403	1810-0280		NETWORK-RES 10-SIP 10.0K OHM X 9
RP404-RP405	1810-0265		NETWORK-RES 16-DIP 680.0 OHM X 8
RP406-RP407	1810-0280		NETWORK-RES 10-SIP 10.0K OHM X 9
RP408	1810-0279		NETWORK-RES 10-SIP 4.7K OHM X 9
SP101	3101-2094	1	SWITCH-DIP ROCKER 8-1A 0.15A 30VDC
U101	1820-3631	2	IC COMPARATOR CMOS/HCT MAGNITUDE 8-BIT
U102	1820-3975	3	IC DRIVER CMOS/HC LINE OCTL
U103	1820-4586	1	IC DRIVER/RECEIVER CMOS/HCT BUS OCTL
U104-U105	1820-3975		IC DRIVER CMOS/HC LINE OCTL
U106	1820-3631		IC COMPARATOR CMOS/HCT MAGNITUDE 8-BIT
U107	1820-4147	1	IC LATCH CMOS/HCT TRANSPARENT OCTL
U108-U109	1820-3714	2	IC TRANSCEIVER TTL/ALS BUS OCTL
U110	1820-3079	2	IC DECODER CMOS/HC BIN 3-TO-8-LINE

Table 3-1. Component Assembly Replaceable Parts (Continued)

Reference Designator	Agilent Part Number	Qty	Part Description
U111	1820-6475	3	IC FIFO CMOS ASYNCHRO 4608-BIT
U112	E1466-88801	1	IC-PAL16L8-25 UNPROGRAMMED 25NS
U113	E1466-88802	1	IC-PAL16L8-25 PROGRAMMED
U114	1820-3079		IC DECODER CMOS/HC BIN 3-TO-8-LINE
U201-U202	1820-4643	2	IC GATE CMOS/HCT NOR QUAD 2-INP
U203	1820-4242	1	IC SCHMITT-TRIG CMOS/HCT INV HEX
U204	1820-3081	2	IC FF CMOS/HC D-TYPE POS-EDGE-TRIG
U205	1820-4590	1	IC MV CMOS/HC MONOSTBL RETRIG DUAL
U206	1820-6731	1	IC-ASIC GATE-ARRAY CMOS
U207	1820-4057	1	IC BUFFER TTL/F NAND QUAD 2-INP
U208	1820-3184	1	IC GATE CMOS/HC AND TPL 3-INP
U209	1820-3081		IC FF CMOS/HC D-TYPE POS-EDGE-TRIG
U210	E1466-88803	1	IC-PAL16R8B-2CN PROGRAMMED
U301	1858-0069	2	TRANSISTOR ARRAY 18-PIN PLASTIC DIP
U302	1820-6475		IC FIFO CMOS ASYNCHRO 4608-BIT
U303	1820-3298	1	IC GATE CMOS/HC OR QUAD 2-INP
U304	1820-5424	2	IC DRIVER CMOS/HCT LINE OCTL
U305-U308	1820-4599	8	IC-INTERFACE DRIVER
U401	1858-0069		TRANSISTOR ARRAY 18-PIN PLASTIC DIP
U402	1820-6475		IC FIFO CMOS ASYNCHRO 4608-BIT
U403	1820-5424		IC DRIVER CMOS/HCT LINE OCTL
U404-U407	1820-4599		IC-INTERFACE DRIVER

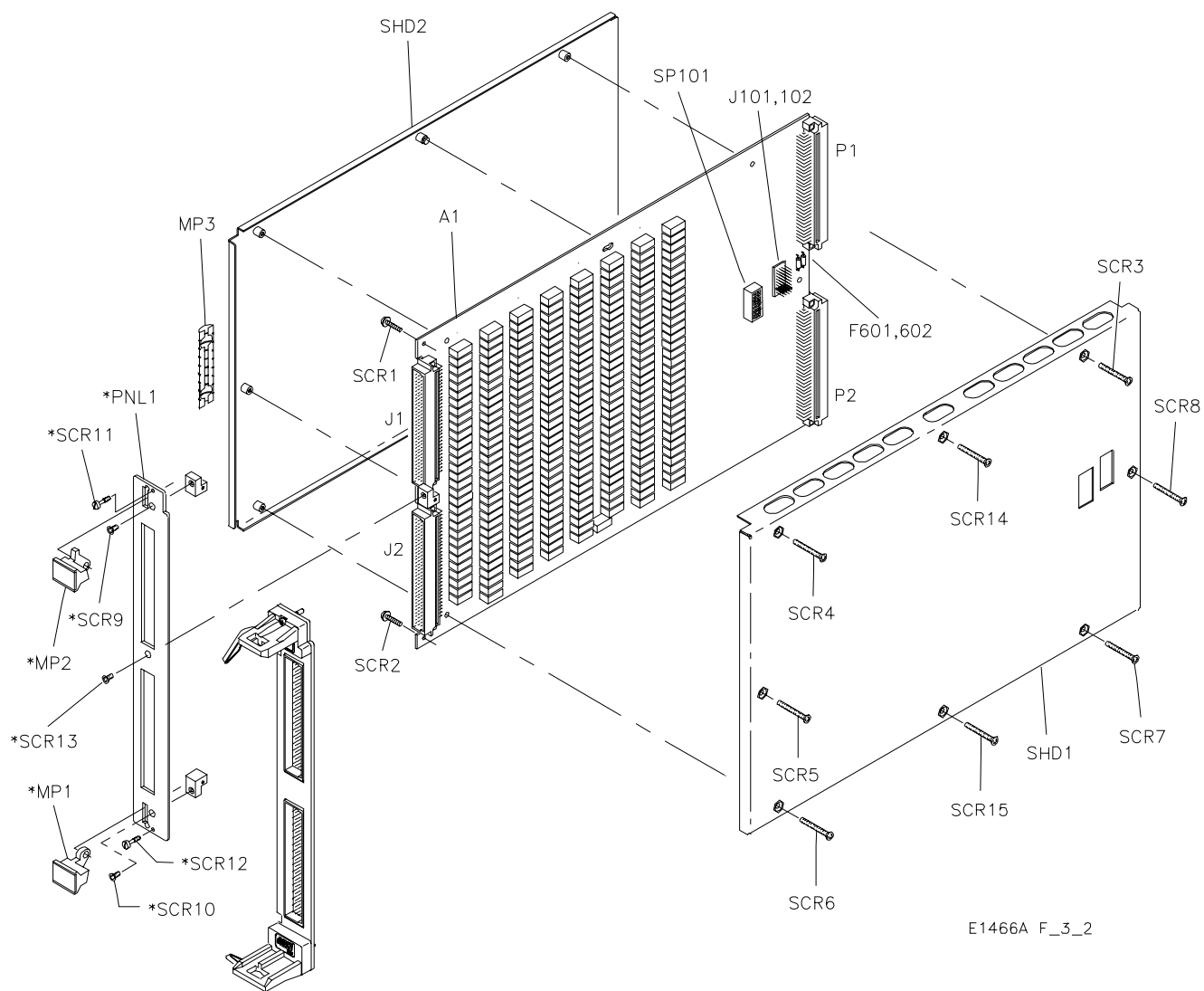


Figure 3-1. Component Assembly Replaceable Parts

Table 3-2. Terminal Case Replaceable Parts

Reference Designator	Agilent Part Number	Qty.	Part Description
1	E1400-84405	1	Case Assembly - Terminal (see Figure 3-2)
2	E1400-45103	1	Top Lever
3	E1400-45104	1	Bottom Lever
4	1460-2552	1	Torsion Spring - Left Hand Wound
5	1460-2553	1	Torsion Spring - Right Hand Wound
6	1390-1027	2	Receptical Quick Fastener

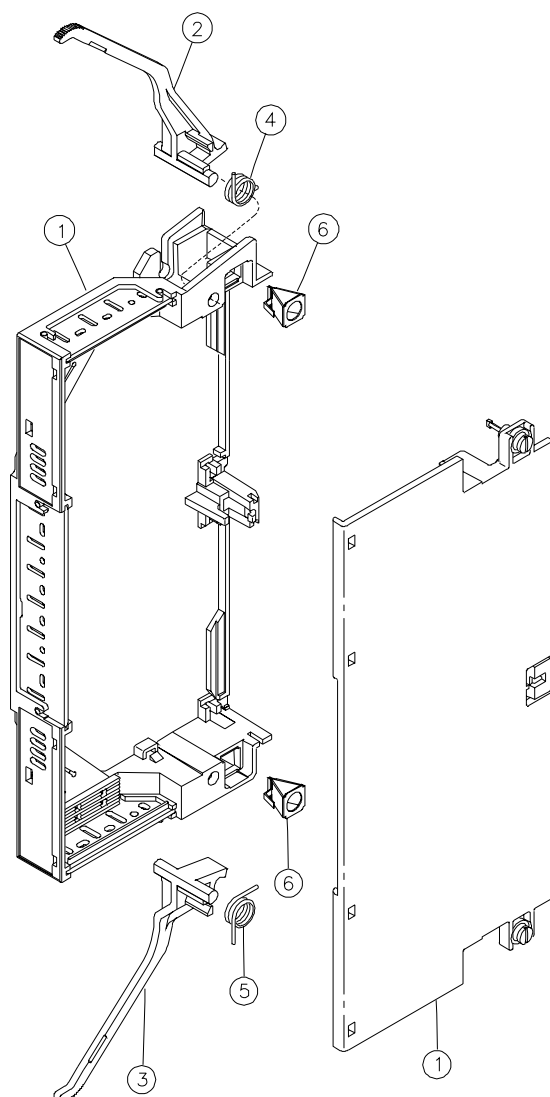


Figure 3-2. Terminal Case Assembly Replaceable Parts

Table 3-3. Terminal Case Replaceable Parts

Reference Designator	Agilent Part Number	Qty	Part Description
A1	E1400-84401	1	CASE TERMINAL BLK ASSY (See Figure 3-3)
MP1	03852-01201	1	CLAMP
MP2	03852-86701	1	PAD-CLAMP
MP3	0515-2109	1	SCREW-MACHINE 10-24 .625-IN-LG PAN-HD-SLT
MP4	1390-0846	2	FASTENER-CAPTIVE SCREW M2.5 X 0.45
MP5	E1300-01202	1	CLAMP STRAIN RELIEF
MP6	E1400-44104	1	TERMINAL HOUSING-BOTTOM
MP7	E1400-44105	1	TERMINAL HOUSING-TOP

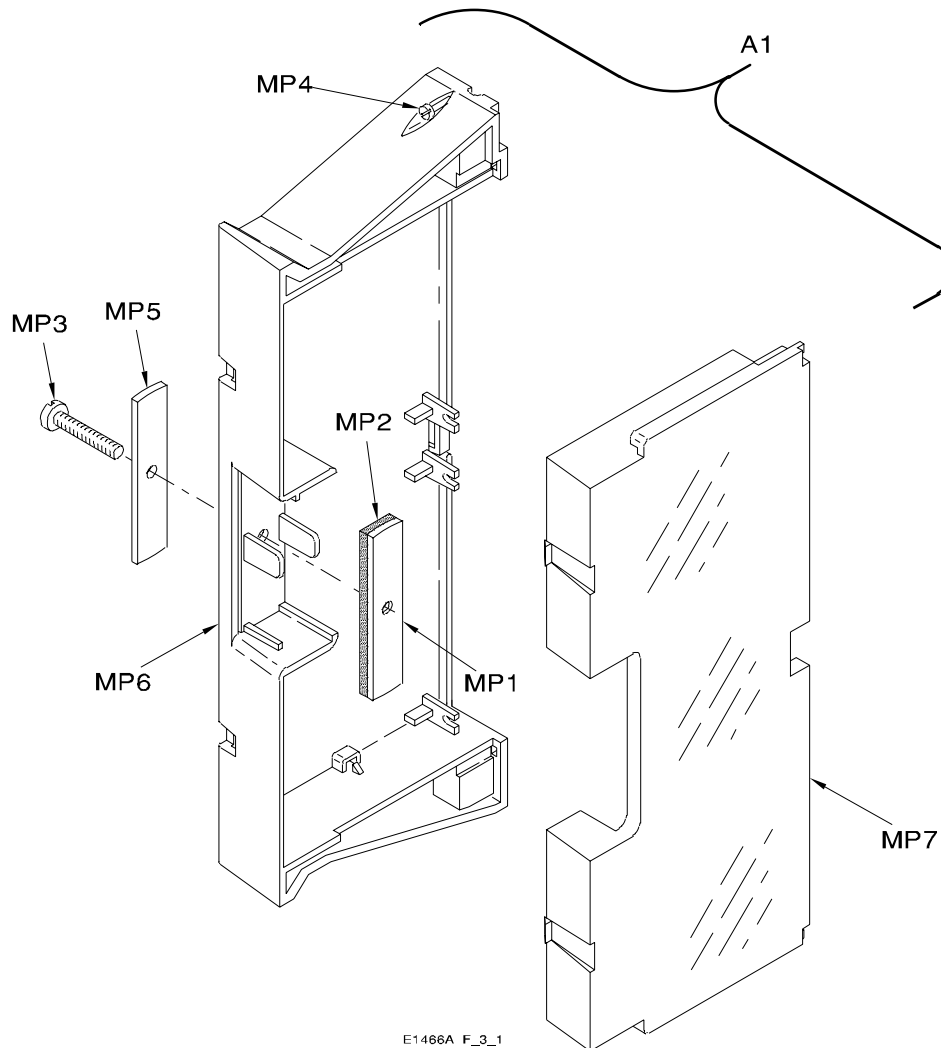


Figure 3-3. Terminal Case Assembly Replaceable Parts

Table 3-4. Agilent E1465A Terminal Module Replaceable Parts

Reference Designator	Agilent Part Number	Qty	Part Description
A3	E1465-66510	1	TERMINAL CARD 16X16 MATRIX (See Figure 3-4)
P1-P2	1252-1593	2	CONNECTOR-POST TYPE 2.54-PIN-SPCG 96-CONTACT
TB1-TB16	0360-2502	16	TERMINAL BLOCK 8 POS. POLYESTER

Table 3-5. Agilent E1466A Terminal Module Replaceable Parts

Reference Designator	Agilent Part Number	Qty	Part Description
A3	E1466-66510	1	PC ASSEMBLY TERMINAL CARD (See Figure 3-5)
P1-P2	1252-1593	2	CONNECTOR-POST TYPE 2.54-PIN-SPCG 96-CONTACT
TB1	0360-2501	8	TERMINAL BLOCK POLYESTER
TB2	0360-2502	8	TERMINAL BLOCK 8 POS. POLYESTER
TB3	0360-2501		TERMINAL BLOCK POLYESTER
TB4	0360-2502		TERMINAL BLOCK 8 POS. POLYESTER
TB5	0360-2501		TERMINAL BLOCK POLYESTER
TB6	0360-2502		TERMINAL BLOCK 8 POS. POLYESTER
TB7	0360-2501		TERMINAL BLOCK POLYESTER
TB8	0360-2502		TERMINAL BLOCK 8 POS. POLYESTER
TB9	0360-2501		TERMINAL BLOCK POLYESTER
TB10	0360-2502		TERMINAL BLOCK 8 POS. POLYESTER
TB11	0360-2501		TERMINAL BLOCK POLYESTER
TB12	0360-2502		TERMINAL BLOCK 8 POS. POLYESTER
TB13-TB14	0360-2501		TERMINAL BLOCK POLYESTER
TB15-TB16	0360-2502		TERMINAL BLOCK 8 POS. POLYESTER

Table 3-6. Agilent E1467A Terminal Module Replaceable Parts

Reference Designator	Agilent Part Number	Qty	Part Description
A3	E1467-66510	1	HI DENSITY MATRIX TERMINAL CARD (See Figure 3-6)
P1-P2	1252-1593	2	CONNECTOR-POST TYPE 2.54-PIN-SPCG 96-CONTACT
TB1-TB12	0360-2502	12	TERMINAL BLOCK 8 POS. POLYESTER

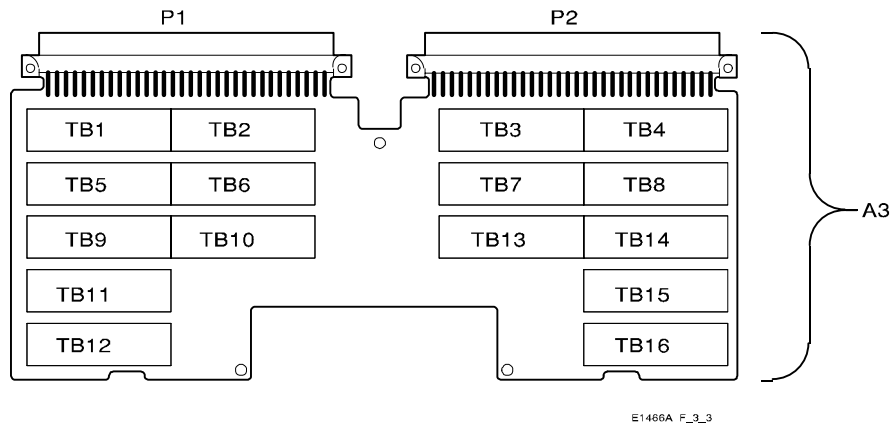


Figure 3-4. Agilent E1465A Terminal Module

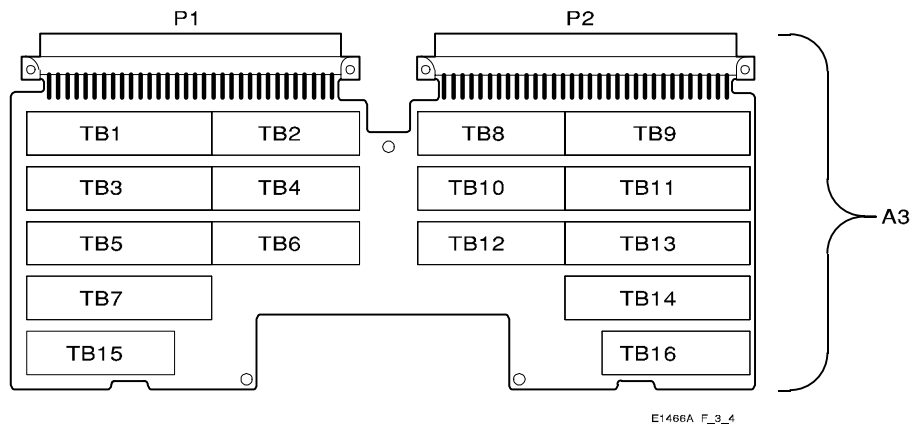


Figure 3-5. Agilent E1466A Terminal Module

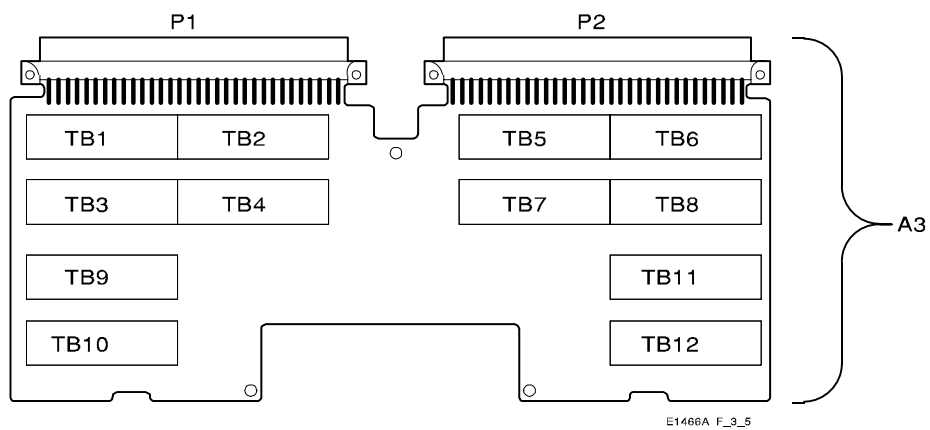


Figure 3-6. Agilent E1467A Terminal Module

Table 3-6. Matrix Module Reference Designators

Reference Designators	
A.....assembly	PCB.....printed circuit board
BRK.....bracket	PNL panel
C.....capacitor	Q transistor
CR diode	R.....resistor
CS case	RP resistor pack
CVR.....cover	RT thermistor probe
F.....fuse	SCR screw
J electrical connector (jack)	SHD shield
JM jumper	SW switch
K.....relay	TB.....terminal block (terminal module)
MP.....mechanical part	U.....integrated circuit
P.....electrical connector (plug)	

Chapter 4

Service

Introduction

This chapter contains service information for the Agilent E1465A/E1466A/E1467A matrix modules, including troubleshooting techniques and repair/maintenance guidelines.

WARNING

Do not perform any of the service procedures shown unless you are a qualified, service-trained technician, and have read the WARNINGS and CAUTIONS in Chapter 1.

Repair Strategy

Agilent Technologies recommends component replacement for the Agilent E1465A/E1466A/E1467A matrix modules. Procedures in this chapter describe troubleshooting techniques. Schematics and Component Locators are located at the back of this manual. Component level replaceable parts lists are contained in *Chapter 3 — Replaceable Parts*. See *Chapter 1 — General Information* for a description of relay life factors.

Equipment Required

Equipment required for matrix module troubleshooting and repair is listed in Table 1-1, *Recommended Test Equipment*. Any equipment that satisfies the requirements given in the table may be substituted.

To avoid damage to the screw head slots, use a T8 Torx driver to remove the front panel handles and a T10 Torx driver to remove the shields.

Service Aids

See *Chapter 3 — Replaceable Parts* for descriptions and locations of Agilent E1465A/E1466A/E1467A matrix modules replaceable parts. Service notes and service literature for the matrix modules may be available through Agilent Technologies. For information, contact your nearest Agilent Technologies Sales and Support Office.

Troubleshooting

To troubleshoot a matrix module problem you must first identify the problem and then isolate the cause of the problem to a replaceable part. See *Chapter 3 — Replaceable Parts* and the component locators at the back of this manual for descriptions and locations of Agilent E1465A/E1466A/E1467A matrix modules replaceable parts.

Identifying the Problem

Table 4-1 lists some common problems, along with symptoms and possible solutions. If the problem persists, perform component-level troubleshooting using the component locators and schematics.

Table 4-1. Agilent E1465A/E1466A/E1467A Common Problems

Problem Type	Symptom	Possible Solutions
Self-test Errors	Non-zero error code in response to the *TST? command.	See Table 4-4 for information on self-test errors.
Operator Errors	Non-zero error code in response to the SYST:ERR? command.	See Appendix C of the the <i>Agilent E1465A/E1466A/E1467A User's Manual</i> for matrix module errors and causes. See Appendix B of the <i>Agilent E1405 User's Manual</i> for additional information on operator errors.
Catastrophic Failures	Not responding to commands.	Check logical address setting. Check GPIB cables and connections. See "Testing the Assembly" in this chapter.
Performance Out of Specification	Failing Closed Channel Resistance Test (see Test 2-1 in Chapter 2). Failing DC Isolation test (See Test 2-2 in Chapter 2)	Check user wiring, test connections, and installed protection devices. Replace relays that correspond to the channels that are failing (see Table 4-3). If most of the channels are near or above the test limit (2.7 Ohms), replace entire printed circuit board (Agilent part number E1466-66501) Check user wiring, test connections, and installed protection devices. Remove dust from relay module and terminal module printed circuit board.

Testing the Assembly

You can use the tests and checks in Table 4-2 to isolate the problem. See Figures 3-1, 3-2, 3-3, 3-4, 3-5, and 3-6 in Chapter 3 for locations of mechanical parts. See the component locator included with this manual for locations of electrical components.

Table 4-2. Agilent E1465A/E1466A/E1467A Tests/Checks

Test/Check	Reference Designator	Check:
Heat Damage	-----	Discolored PC boards Damaged insulation Evidence of arcing
Matrix/Jumper Settings	J101, J102 SP101	IRQ Level setting LADDR setting
Matrix Module PCA	F601, F602 P1, P2, J1, J2 K0-K1515	Fuse continuity Connector contacts Test 2-1, Closed Channel Resistance Test

Checking for Heat Damage

Inspect the assembly for signs of abnormal internally generated heat such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing.

Checking Matrixes/Jumpers

Verify that the matrix logical address is set correctly (factory set at 120). Verify that the interrupt priority jumpers are set correctly (factory set at level 1).

Checking the Matrix Module PCA

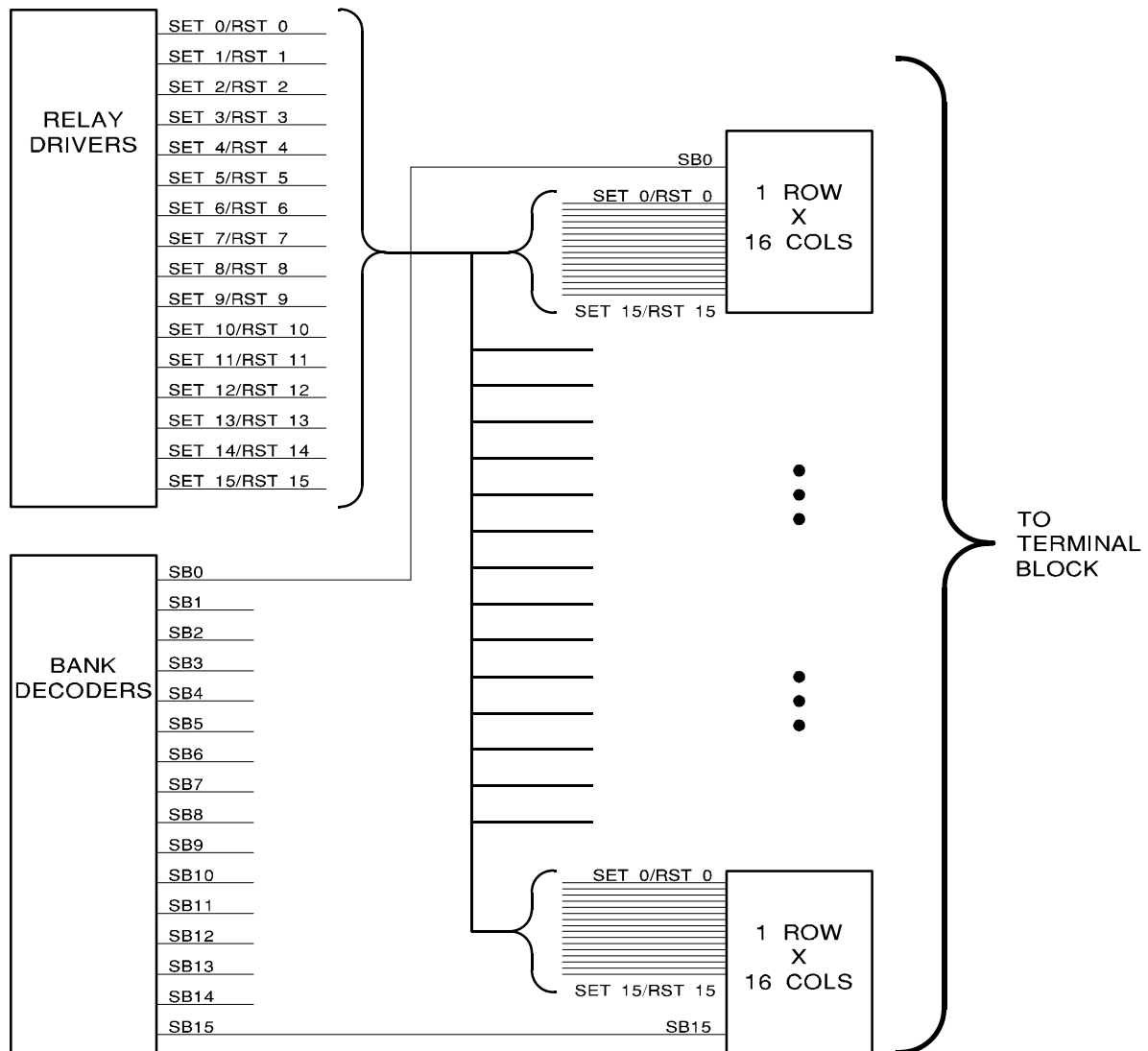
Check the following:

- Verify that fuses F601 and F602 are good.
- Check connectors J1, J2, P1, and P2 for damage.
- Perform Test 2-1 in Chapter 2.

Relay Driver Description

Figure 4-1 shows a simplified diagram of the relay driver and decoder circuits. As shown in the figure, the relays on the component assembly are arranged into 16 banks of 16 relays. Each bank of relays switches 16 columns to a single row.

The relay contacts are arranged into four 4 X 16 submatrixes. These submatrixes are then arranged into the appropriate matrixes by each terminal module. The latching relays are double pole and switch both HI and LO lines.



E1466A F_4_1

Figure 4-1. Relay Driver/Decoder Simplified Diagram

Matching Relays to Channels

Use Table 4-3 to help match channel numbers to relay and drive circuit reference designators.

Table 4-3. Channel Relays/Reference Designators

Agilent E1465A				Agilent E1466A				Agilent E1467A			
CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder
R00 C00	K000	U305	Q301, U301, U112	R00 C00	K000	U305	Q301, U301, U112	R00 C00	K000	U305	Q301, U301, U112
R00 C01	K001			R00 C01	K001			R00 C01	K001		
R00 C02	K002	U306		R00 C02	K002	U306		R00 C02	K002	U306	
R00 C03	K003			R00 C03	K003			R00 C03	K003		
R00 C04	K004	U307		R00 C04	K004	U307		R00 C04	K004	U307	
R00 C05	K005			R00 C05	K005			R00 C05	K005		
R00 C06	K006	U308		R00 C06	K006	U308		R00 C06	K006	U308	
R00 C07	K007			R00 C07	K007			R00 C07	K007		
R00 C08	K008	U404		R00 C08	K008	U404		R00 C08	K008	U404	
R00 C09	K009			R00 C09	K009			R00 C09	K009		
R00 C10	K010	U405		R00 C10	K010	U405		R00 C10	K010	U405	
R00 C11	K011			R00 C11	K011			R00 C11	K011		
R00 C12	K012	U406		R00 C12	K012	U406		R00 C12	K012	U406	
R00 C13	K013			R00 C13	K013			R00 C13	K013		
R00 C14	K014	U407		R00 C14	K014	U407		R00 C14	K014	U407	
R00 C15	K015			R00 C15	K015			R00 C15	K015		
R01 C00	K100	U305	Q302, U301, U112	R00 C16	K400	U305	Q305, U301, U112	R00 C16	K800	U305	Q401, U401, U113
R01 C01	K101			R00 C17	K401			R00 C17	K801		
R01 C02	K102	U306		R00 C18	K402	U306		R00 C18	K802	U306	
R01 C03	K103			R00 C19	K403			R00 C19	K803		
R01 C04	K104	U307		R00 C20	K404	U307		R00 C20	K804	U307	
R01 C05	K105			R00 C21	K405			R00 C21	K805		
R01 C06	K106	U308		R00 C22	K406	U308		R00 C22	K806	U308	
R01 C07	K107			R00 C23	K407			R00 C23	K807		
R01 C08	K108	U404		R00 C24	K408	U404		R00 C24	K808	U404	
R01 C09	K109			R00 C25	K409			R00 C25	K809		
R01 C10	K110	U405		R00 C26	K410	U405		R00 C26	K810	U405	
R01 C11	K111			R00 C27	K411			R00 C27	K811		
R01 C12	K112	U406		R00 C28	K412	U406		R00 C28	K812	U406	
R01 C13	K113			R00 C29	K413			R00 C29	K813		
R01 C14	K114	U407		R00 C30	K414	U407		R00 C30	K814	U407	
R01 C15	K115			R00 C31	K415			R00 C31	K815		

Table 4-3. Channel Relays/Reference Designators (Continued)

Agilent E1465A				Agilent E1466A				Agilent E1467A			
CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder
R02 C00	K200	U305	Q303, U301, U112	R00 C32	K800	U305	Q401, U401, U113	R01 C00	K100	U305	Q302, U301, U112
R02 C01	K201			R00 C33	K801			R01 C01	K101		
R02 C02	K202	U306		R00 C34	K802	U306		R01 C02	K102	U306	
R02 C03	K203			R00 C35	K803			R01 C03	K103		
R02 C04	K204	U307		R00 C36	K804	U307		R01 C04	K104	U307	
R02 C05	K205			R00 C37	K805			R01 C05	K105		
R02 C06	K206	U308		R00 C38	K806	U308		R01 C06	K106	U308	
R02 C07	K207			R00 C39	K807			R01 C07	K107		
R02 C08	K208	U404		R00 C40	K808	U404		R01 C08	K108	U404	
R02 C09	K209			R00 C41	K809			R01 C09	K109		
R02 C10	K210	U405		R00 C42	K810	U405		R01 C10	K110	U405	
R02 C11	K211			R00 C43	K811			R01 C11	K111		
R02 C12	K212	U406		R00 C44	K812	U406		R01 C12	K112	U406	
R02 C13	K213			R00 C45	K813			R01 C13	K113		
R02 C14	K214	U407		R00 C46	K814	U407		R01 C14	K114	U407	
R02 C15	K215			R00 C47	K815			R01 C15	K115		
R03 C00	K300	U305	Q304, U301, U112	R00 C48	K1200	U305	Q405, U401, U113	R01 C16	K900	U305	Q402, U401, U113
R03 C01	K301			R00 C49	K1201			R01 C17	K901		
R03 C02	K302	U306		R00 C50	K1202	U306		R01 C18	K902	U306	
R03 C03	K303			R00 C51	K1203			R01 C19	K903		
R03 C04	K304	U307		R00 C52	K1204	U307		R01 C20	K904	U307	
R03 C05	K305			R00 C53	K1205			R01 C21	K905		
R03 C06	K306	U308		R00 C54	K1206	U308		R01 C22	K906	U308	
R03 C07	K307			R00 C55	K1207			R01 C23	K907		
R03 C08	K308	U404		R00 C56	K1208	U404		R01 C24	K908	U404	
R03 C09	K309			R00 C57	K1209			R01 C25	K909		
R03 C10	K310	U405		R00 C58	K1210	U405		R01 C26	K910	U405	
R03 C11	K311			R00 C59	K1211			R01 C27	K911		
R03 C12	K312	U406		R00 C60	K1212	U406		R01 C28	K912	U406	
R03 C13	K313			R00 C61	K1213			R01 C29	K913		
R03 C14	K314	U407		R00 C62	K1214	U407		R01 C30	K914	U407	
R03 C15	K315			R00 C63	K1215			R01 C31	K915		

Table 4-3. Channel Relays/Reference Designators (Continued)

Agilent E1465A				Agilent E1466A				Agilent E1467A			
CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder
R04 C00	K400	U305	Q305, U301, U112	R01 C00	K100	U305	Q302, U301, U112	R02 C00	K200	U305	Q303, U301, U112
R04 C01	K401			R01 C01	K101			R02 C01	K201		
R04 C02	K402	U306		R01 C02	K102	U306		R02 C02	K202	U306	
R04 C03	K403			R01 C03	K103			R02 C03	K203		
R04 C04	K404	U307		R01 C04	K104	U307		R02 C04	K204	U307	
R04 C05	K405			R01 C05	K105			R02 C05	K205		
R04 C06	K406	U308		R01 C06	K106	U308		R02 C06	K206	U308	
R04 C07	K407			R01 C07	K107			R02 C07	K207		
R04 C08	K408	U404		R01 C08	K108	U404		R02 C08	K208	U404	
R04 C09	K409			R01 C09	K109			R02 C09	K209		
R04 C10	K410	U405		R01 C10	K110	U405		R02 C10	K210	U405	
R04 C11	K411			R01 C11	K111			R02 C11	K211		
R04 C12	K412	U406		R01 C12	K112	U406		R02 C12	K212	U406	
R04 C13	K413			R01 C13	K113			R02 C13	K213		
R04 C14	K414	U407		R01 C14	K114	U407		R02 C14	K214	U407	
R04 C15	K415			R01 C15	K115			R02 C15	K215		
R05 C00	K500	U305	Q306, U301, U112	R01 C16	K500	U305	Q306, U301, U112	R02 C16	K1000	U305	Q403, U401, U113
R05 C01	K501			R01 C17	K501			R02 C17	K1001		
R05 C02	K502	U306		R01 C18	K502	U306		R02 C18	K1002	U306	
R05 C03	K503			R01 C19	K503			R02 C19	K1003		
R05 C04	K504	U307		R01 C20	K504	U307		R02 C20	K1004	U307	
R05 C05	K505			R01 C21	K505			R02 C21	K1005		
R05 C06	K506	U308		R01 C22	K506	U308		R02 C22	K1006	U308	
R05 C07	K507			R01 C23	K507			R02 C23	K1007		
R05 C08	K508	U404		R01 C24	K508	U404		R02 C24	K1008	U404	
R05 C09	K509			R01 C25	K509			R02 C25	K1009		
R05 C10	K510	U405		R01 C26	K510	U405		R02 C26	K1010	U405	
R05 C11	K511			R01 C27	K511			R02 C27	K1011		
R05 C12	K512	U406		R01 C28	K512	U406		R02 C28	K1012	U406	
R05 C13	K513			R01 C29	K513			R02 C29	K1013		
R05 C14	K514	U407		R01 C30	K514	U407		R02 C30	K1014	U407	
R05 C15	K515			R01 C31	K515			R02 C31	K1015		

Table 4-3. Channel Relays/Reference Designators (Continued)

Agilent E1465A				Agilent E1466A				Agilent E1467A			
CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder
R06 C00	K600	U305	Q307, U301, U112	R01 C32	K900	U305	Q402, U401, U113	R03 C00	K300	U305	Q304, U301, U112
R06 C01	K601			R01 C33	K901			R03 C01	K301		
R06 C02	K602	U306		R01 C34	K902	U306		R03 C02	K302	U305	
R06 C03	K603			R01 C35	K903			R03 C03	K303		
R06 C04	K604	U307		R01 C36	K904	U307		R03 C04	K304	U306	
R06 C05	K605			R01 C37	K905			R03 C05	K305		
R06 C06	K606	U308		R01 C38	K906	U308		R03 C06	K306	U307	
R06 C07	K607			R01 C39	K907			R03 C07	K307		
R06 C08	K608	U404		R01 C40	K908	U404		R03 C08	K308	U404	
R06 C09	K609			R01 C41	K909			R03 C09	K309		
R06 C10	K610	U405		R01 C42	K910	U405		R03 C10	K310	U405	
R06 C11	K611			R01 C43	K911			R03 C11	K311		
R06 C12	K612	U406		R01 C44	K912	U406		R03 C12	K312	U406	
R06 C13	K613			R01 C45	K913			R03 C13	K313		
R06 C14	K614	U407		R01 C46	K914	U407		R03 C14	K314	U407	
R06 C15	K615			R01 C47	K915			R03 C15	K315		
R07 C00	K700	U305	Q308, U301, U112	R01 C48	K1300	U305	Q406, Q401, U113	R03 C16	K1100	U305	Q404, U401, U113
R07 C01	K701			R01 C49	K1301			R03 C17	K1101		
R07 C02	K702	U306		R01 C50	K1302	U306		R03 C18	K1102	U306	
R07 C03	K703			R01 C51	K1303			R03 C19	K1103		
R07 C04	K704	U307		R01 C52	K1304	U307		R03 C20	K1104	U307	
R07 C05	K705			R01 C53	K1305			R03 C21	K1105		
R07 C06	K706	U308		R01 C54	K1306	U308		R03 C22	K1106	U308	
R07 C07	K707			R01 C55	K1307			R03 C23	K1107		
R07 C08	K708	U404		R01 C56	K1308	U404		R03 C24	K1108	U404	
R07 C09	K709			R01 C57	K1309			R03 C25	K1109		
R07 C10	K710	U405		R01 C58	K1310	U405		R03 C26	K1110	U405	
R07 C11	K711			R01 C59	K1311			R03 C27	K1111		
R07 C12	K712	U406		R01 C60	K1312	U406		R03 C28	K1112	U406	
R07 C13	K713			R01 C61	K1313			R03 C29	K1113		
R07 C14	K714	U407		R01 C62	K1314	U407		R03 C30	K1114	U407	
R07 C15	K715			R01 C63	K1315			R03 C31	K1115		

Table 4-3. Channel Relays/Reference Designators (Continued)

Agilent E1465A				Agilent E1466A				Agilent E1467A			
CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder
R08 C00	K800	U305	Q401, U401, U113	R02 C00	K200	U305	Q303, U301, U112	R04 C00	K400	U305	Q305, U301, U112
R08 C01	K801			R02 C01	K201			R04 C01	K401		
R08 C02	K802	U306		R02 C02	K202	U306		R04 C02	K402	U306	
R08 C03	K803			R02 C03	K203			R04 C03	K403		
R08 C04	K804	U307		R02 C04	K204	U307		R04 C04	K404	U307	
R08 C05	K805			R02 C05	K205			R04 C05	K405		
R08 C06	K806	U308		R02 C06	K206	U308		R04 C06	K406	U308	
R08 C07	K807			R02 C07	K207			R04 C07	K407		
R08 C08	K808	U404		R02 C08	K208	U404		R04 C08	K408	U404	
R08 C09	K809			R02 C09	K209			R04 C09	K409		
R08 C10	K810	U405		R02 C10	K210	U405		R04 C10	K410	U405	
R08 C11	K811			R02 C11	K211			R04 C11	K411		
R08 C12	K812	U406		R02 C12	K212	U406		R04 C12	K412	U406	
R08 C13	K813			R02 C13	K213			R04 C13	K413		
R08 C14	K814	U407		R02 C14	K214	U407		R04 C14	K414	U407	
R08 C15	K815			R02 C15	K215			R04 C15	K415		
R09 C00	K900	U305	Q402, U401, U113	R02 C16	K600	U305	Q307, U301, U112	R04 C16	K1200	U305	Q405, U401, U113
R09 C01	K901			R02 C17	K601			R04 C17	K1201		
R09 C02	K902	U306		R02 C18	K602	U306		R04 C18	K1202	U306	
R09 C03	K903			R02 C19	K603			R04 C19	K1203		
R09 C04	K904	U307		R02 C20	K604	U307		R04 C20	K1204	U307	
R09 C05	K905			R02 C21	K605			R04 C21	K1205		
R09 C06	K906	U308		R02 C22	K606	U308		R04 C22	K1206	U308	
R09 C07	K907			R02 C23	K607			R04 C23	K1207		
R09 C08	K908	U404		R02 C24	K608	U404		R04 C24	K1208	U404	
R09 C09	K909			R02 C25	K609			R04 C25	K1209		
R09 C10	K910	U405		R02 C26	K610	U405		R04 C26	K1210	U405	
R09 C11	K911			R02 C27	K611			R04 C27	K1211		
R09 C12	K912	U406		R02 C28	K612	U406		R04 C28	K1212	U406	
R09 C13	K913			R02 C29	K613			R04 C29	K1213		
R09 C14	K914	U407		R02 C30	K614	U407		R04 C30	K1214	U407	
R09 C15	K915			R02 C31	K615			R04 C31	K1215		

Table 4-3. Channel Relays/Reference Designators (Continued)

Agilent E1465A				Agilent E1466A				Agilent E1467A			
CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder
R10 C00	K1000	U305	Q403, U401, U113	R02 C32	K1000	U305	Q403, U401, U113	R05 C00	K500	U305	Q306, U301, U112
R10 C01	K1001			R02 C33	K1001			R05 C01	K501		
R10 C02	K1002	U306		R02 C34	K1002	U306		R05 C02	K502	U306	
R10 C03	K1003			R02 C35	K1003			R05 C03	K503		
R10 C04	K1004	U307		R02 C36	K1004	U307		R05 C04	K504	U307	
R10 C05	K1005			R02 C37	K1005			R05 C05	K505		
R10 C06	K1006	U308		R02 C38	K1006	U308		R05 C06	K506	U308	
R10 C07	K1007			R02 C39	K1007			R05 C07	K507		
R10 C08	K1008	U404		R02 C40	K1008	U404		R05 C08	K508	U404	
R10 C09	K1009			R02 C41	K1009			R05 C09	K509		
R10 C10	K1010	U405		R02 C42	K1010	U405		R05 C10	K510	U405	
R10 C11	K1011			R02 C43	K1011			R05 C11	K511		
R10 C12	K1012	U406		R02 C44	K1012	U406		R05 C12	K512	U406	
R10 C13	K1013			R02 C45	K1013			R05 C13	K513		
R10 C14	K1014	U407		R02 C46	K1014	U407		R05 C14	K514	U407	
R10 C15	K1015			R02 C47	K1015			R05 C15	K515		
R11 C00	K1100	U305	Q404, U401, U113	R02 C48	K1400	U305	Q407, U401, U113	R05 C16	K1300	U305	Q406, U401, U113
R11 C01	K1101			R02 C49	K1401			R05 C17	K1301		
R11 C02	K1102	U306		R02 C50	K1402	U306		R05 C18	K1302	U306	
R11 C03	K1103			R02 C51	K1403			R05 C19	K1303		
R11 C04	K1104	U307		R02 C52	K1404	U307		R05 C20	K1304	U307	
R11 C05	K1105			R02 C53	K1405			R05 C21	K1305		
R11 C06	K1106	U308		R02 C54	K1406	U308		R05 C22	K1306	U308	
R11 C07	K1107			R02 C55	K1407			R05 C23	K1307		
R11 C08	K1108	U404		R02 C56	K1408	U404		R05 C24	K1308	U404	
R11 C09	K1109			R02 C57	K1409			R05 C25	K1309		
R11 C10	K1110	U405		R02 C58	K1410	U405		R05 C26	K1310	U405	
R11 C11	K1111			R02 C59	K1411			R05 C27	K1311		
R11 C12	K1112	U406		R02 C60	K1412	U406		R05 C28	K1312	U406	
R11 C13	K1113			R02 C61	K1413			R05 C29	K1313		
R11 C14	K1114	U407		R02 C62	K1414	U407		R05 C30	K1314	U407	
R11 C15	K1115			R02 C63	K1415			R05 C31	K1315		

Table 4-3. Channel Relays/Reference Designators (Continued)

Agilent E1465A				Agilent E1466A				Agilent E1467A			
CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder
R12 C00	K1200	U305	Q405, U401, U113	R03 C00	K300	U305	Q304, U301, U112	R06 C00	K600	U305	Q307, U301, U112
R12 C01	K1201			R03 C01	K301			R06 C01	K601		
R12 C02	K1202	U306		R03 C02	K302	U306		R06 C02	K602	U306	
R12 C03	K1203			R03 C03	K303			R06 C03	K603		
R12 C04	K1204	U307		R03 C04	K304	U307		R06 C04	K604	U307	
R12 C05	K1205			R03 C05	K305			R06 C05	K605		
R12 C06	K1206	U308		R03 C06	K306	U308		R06 C06	K606	U308	
R12 C07	K1207			R03 C07	K307			R06 C07	K607		
R12 C08	K1208	U404		R03 C08	K308	U404		R06 C08	K608	U404	
R12 C09	K1209			R03 C09	K309			R06 C09	K609		
R12 C10	K1210	U405		R03 C10	K310	U405		R06 C10	K610	U405	
R12 C11	K1211			R03 C11	K311			R06 C11	K611		
R12 C12	K1212	U406		R03 C12	K312	U406		R06 C12	K612	U406	
R12 C13	K1213			R03 C13	K313			R06 C13	K613		
R12 C14	K1214	U407		R03 C14	K314	U407		R06 C14	K614	U407	
R12 C15	K1215			R03 C15	K315			R06 C15	K615		
R13 C00	K1300	U305	Q406, U401, U113	R03 C16	K700	U305	Q308, U301, U112	R06 C16	K1400	U305	Q407, U401, U113
R13 C01	K1301			R03 C17	K701			R06 C17	K1401		
R13 C02	K1302	U306		R03 C18	K702	U306		R06 C18	K1402	U306	
R13 C03	K1303			R03 C19	K703			R06 C19	K1403		
R13 C04	K1304	U307		R03 C20	K704	U307		R06 C20	K1404	U307	
R13 C05	K1305			R03 C21	K705			R06 C21	K1405		
R13 C06	K1306	U308		R03 C22	K706	U308		R06 C22	K1406	U308	
R13 C07	K1307			R03 C23	K707			R06 C23	K1407		
R13 C08	K1308	U404		R03 C24	K708	U404		R06 C24	K1408	U404	
R13 C09	K1309			R03 C25	K709			R06 C25	K1409		
R13 C10	K1310	U405		R03 C26	K710	U405		R06 C26	K1410	U405	
R13 C11	K1311			R03 C27	K711			R06 C27	K1411		
R13 C12	K1312	U406		R03 C28	K712	U406		R06 C28	K1412	U406	
R13 C13	K1313			R03 C29	K713			R06 C29	K1413		
R13 C14	K1314	U407		R03 C30	K714	U407		R06 C30	K1414	U407	
R13 C15	K1315			R03 C31	K715			R06 C31	K1415		

Table 4-3. Channel Relays/Reference Designators (Continued)

Agilent E1465A				Agilent E1466A				Agilent E1467A			
CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder	CH #	Relay	Relay Driver	Bank Decoder
R14 C00	K1400	U305	Q407, U401, U113	R03 C32	K1100	U305	Q404, U401, U113	R07 C00	K700	U305	Q308, U301, U112
R14 C01	K1401			R03 C33	K1101			R07 C01	K701		
R14 C02	K1402	U306		R03 C34	K1102	U306		R07 C02	K702	U306	
R14 C03	K1403			R03 C35	K1103			R07 C03	K703		
R14 C04	K1404	U307		R03 C36	K1104	U307		R07 C04	K704	U307	
R14 C05	K1405			R03 C37	K1105			R07 C05	K705		
R14 C06	K1406	U308		R03 C38	K1106	U308		R07 C06	K706	U308	
R14 C07	K1407			R03 C39	K1107			R07 C07	K707		
R14 C08	K1408	U404		R03 C40	K1108	U404		R07 C08	K708	U404	
R14 C09	K1409			R03 C41	K1109			R07 C09	K709		
R14 C10	K1410	U405		R03 C42	K1110	U405		R07 C10	K710	U405	
R14 C11	K1411			R03 C43	K1111			R07 C11	K711		
R14 C12	K1412	U406		R03 C44	K1112	U406		R07 C12	K712	U406	
R14 C13	K1413			R03 C45	K1113			R07 C13	K713		
R14 C14	K1414	U407		R03 C46	K1114	U407		R07 C14	K714	U407	
R14 C15	K1415			R03 C47	K1115			R07 C15	K715		
R15 C00	K1500	U305	Q408, U401, U113	R03 C48	K1500	U305	Q408, U401, U113	R07 C16	K1500	U305	Q408, U401, U113
R15 C01	K1501			R03 C49	K1501			R07 C17	K1501		
R15 C02	K1502	U306		R03 C50	K1502	U306		R07 C18	K1502	U306	
R15 C03	K1503			R03 C51	K1503			R07 C19	K1503		
R15 C04	K1504	U307		R03 C52	K1504	U307		R07 C20	K1504	U307	
R15 C05	K1505			R03 C53	K1505			R07 C21	K1505		
R15 C06	K1506	U308		R03 C54	K1506	U308		R07 C22	K1506	U308	
R15 C07	K1507			R03 C55	K1507			R07 C23	K1507		
R15 C08	K1508	U404		R03 C56	K1508	U404		R07 C24	K1508	U404	
R15 C09	K1509			R03 C57	K1509			R07 C25	K1509		
R15 C10	K1510	U405		R03 C58	K1510	U405		R07 C26	K1510	U405	
R15 C11	K1511			R03 C59	K1511			R07 C27	K1511		
R15 C12	K1512	U406		R03 C60	K1512	U406		R07 C28	K1512	U406	
R15 C13	K1513			R03 C61	K1513			R07 C29	K1513		
R15 C14	K1514	U407		R03 C62	K1514	U407		R07 C30	K1514	U407	
R15 C15	K1515			R03 C63	K1515			R07 C31	K1515		

Self-Test Error Codes

Table 4-4 shows the self-test error codes for the matrix modules. The meaning of each code is given in the right-hand column. If a self-test failure occurs, cycle power and repeat the test. If the problem reoccurs, the device may need repair.

Table 4-4. Self-test Error Codes

Error*	Description
+0	Self-test passes
+nn01	Firmware error
+nn02	Bus error (communications problem with card)
+nn03	Bad ID information in ID register
+nn10	Interrupt expected but not received
+nn11	Busy bit was not held ≈ 10.5 to 18.5 msec

*nn = card number (with leading zero deleted)

Disassembly

Use the following procedures to disassemble the Agilent E1465A/E1466A/E1467A matrix modules. For disassembly refer to Figure 4-1.

1. To remove the covers:

- Remove the eight T10 Torx screws from the top cover as shown.
- Lift the top cover off of the module.
- Turn the assembly over and lift off the bottom cover.

2. To remove the front panel:

- Remove the two T8 Torx screws from the front panel handles as shown.
- Remove the T8 Torx screw holding the panel to the A1 PC Assembly as shown.
- Lift the front panel from the A1 assembly.

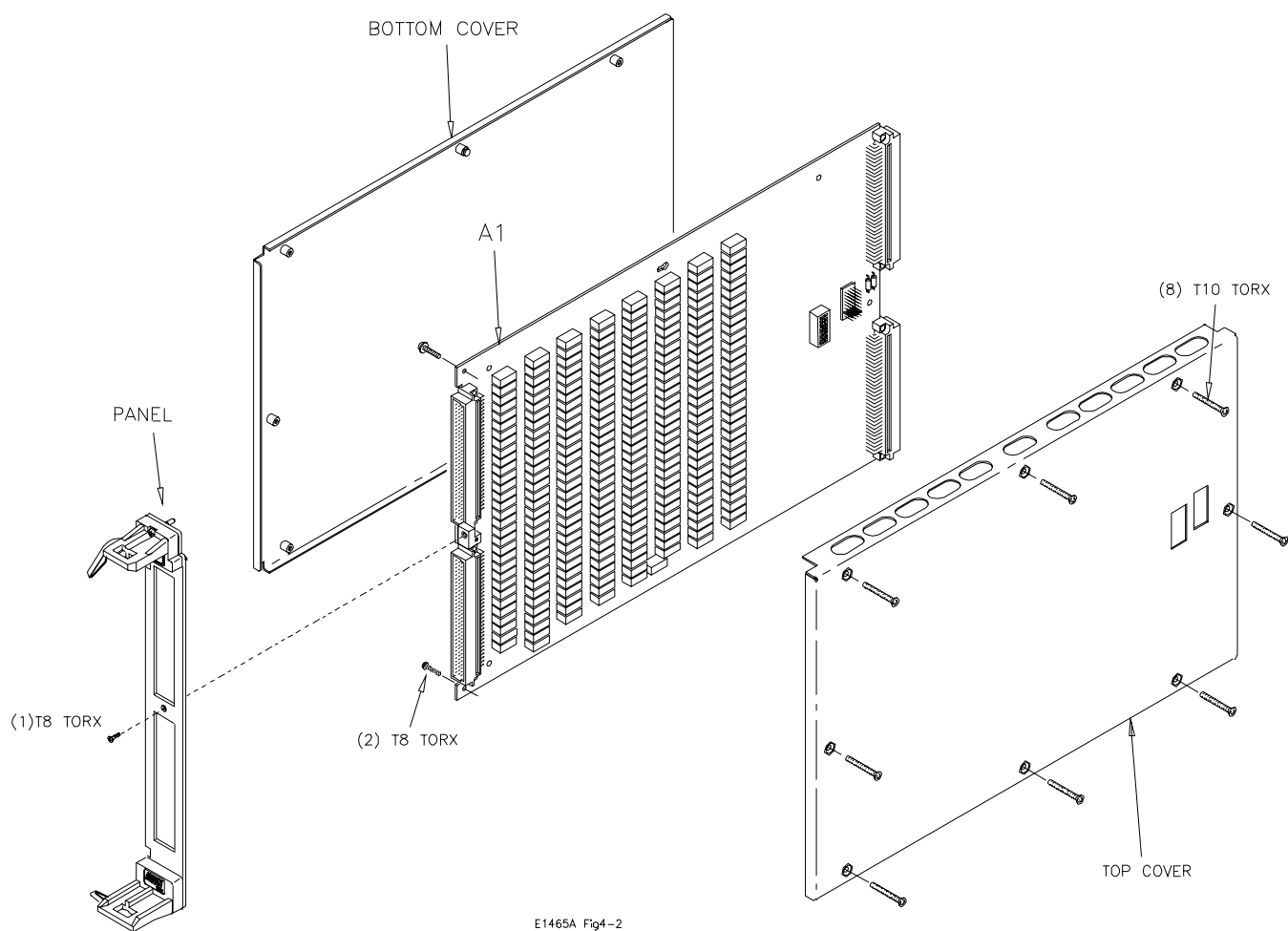


Figure 4-2. E1465A/E1466A/E1467A Disassembly

Repair/ Maintenance Guidelines

This section provides guidelines for repairing and maintaining the Agilent E1465A/E1466A/E1467A matrix modules, including:

- ESD precautions
- Soldering printed circuit boards
- Post-repair safety checks

ESD Precautions

Electrostatic discharge (ESD) may damage static-sensitive devices in the matrix modules. This damage can range from slight parameter degradation to catastrophic failure. When handling the matrix module assemblies, follow these guidelines to avoid damaging components:

- Always use a static-free work station with a pad of conductive rubber or similar material when handling electronic components.
- Do not use pliers to remove a MOS or CMOS device from a high-grip socket. Instead, use a small screwdriver to pry the device up from one end. Slowly lift the device up, one pair of pins at a time.
- After you remove a MOS or CMOS device from a module, place the device onto a pad of conductive foam or other suitable holding material.
- If a device requires soldering, be sure the assembly is placed on a pad of conductive material. Also, be sure that you, the pad, and the soldering iron tip are grounded to the assembly.

Soldering Printed Circuit Boards

The etched circuit boards in the matrix modules have plated-through holes that allow a solder path to both sides of the insulating material. Soldering can be done from either side of the board with equally good results. When soldering to any circuit board, keep in mind the following guidelines:

- Do not use a high power soldering iron on etched circuit boards, as excessive heat may lift a conductor or damage the board.
- Use a suction device or wooden toothpick to remove solder from component mounting holes. When using a suction device, be sure that the equipment is properly grounded.

Post-Repair Safety Checks

After making repairs to the module, inspect the device for any signs of abnormal internally generated heat, such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and correct the cause of the condition. Then perform the Functional Verification Test described in Chapter 2 to verify that the device is functional.

Component Locators and Schematic Diagrams

Table 4-5 lists Component Locator Diagrams and Schematic Diagrams for the Agilent E1465A/E1466A/E1467A matrix modules.

Table 4-5. Component Locators and Schematics Diagrams

	Part Number	Drawing Number	Drawing Title
Component Locator Diagram	E1466-66501	L-E1466-66501 (1 of 2)	E1465A/66A/67A Matrix Switches Component Assembly (Side A)
		L-E1466-66501 (1 of 2)	E1465A/66A/67A Matrix Switches Component Assembly (Side B)
Schematic Diagrams	E1466-66501	S-E1466-66501 (1 of 13)	E1465A/66A/67A Matrix Switches - VXI Interface #1
	E1466-66501	S-E1466-66501 (2 of 13)	E1465A/66A/67A Matrix Switches - VXI Interface #2
	E1466-66501	S-E1466-66501 (3 of 13)	E1465A/66A/67A Matrix Switches - Relay Dvrs 0-7
	E1466-66501	S-E1466-66501 (4 of 13)	E1465A/66A/67A Matrix Switches - Relay Dvrs 8-15
	E1466-66501	S-E1466-66501 (5 of 13)	E1465A/66A/67A Matrix Switches - Bank 0/1 A_Col
	E1466-66501	S-E1466-66501 (6 of 13)	E1465A/66A/67A Matrix Switches - Bank 2/3 A_Col
	E1466-66501	S-E1466-66501 (7 of 13)	E1465A/66A/67A Matrix Switches - Bank 4/5 B_Col
	E1466-66501	S-E1466-66501 (8 of 13)	E1465A/66A/67A Matrix Switches - Bank 6/7 B_Col
	E1466-66501	S-E1466-66501 (9 of 13)	E1465A/66A/67A Matrix Switches - Bank 8/9 C_Col
	E1466-66501	S-E1466-66501 (10 of 13)	E1465A/66A/67A Matrix Switches - Bank 10/11 C_Col
	E1466-66501	S-E1466-66501 (11 of 13)	E1465A/66A/67A Matrix Switches - Bank 12/13 D_Col
	E1466-66501	S-E1466-66501 (12 of 13)	E1465A/66A/67A Matrix Switches - Bank 14/15 D_Col
	E1466-66501	S-E1466-66501 (13 of 13)	E1465A/66A/67A Matrix Switches - VXI Connectors